NEW YORK SEATTLE

MOTORSHIP

Devoted to Commercial and Naval Motor Craft

"MOTORSHIP" is entered as second-class matter at the Post-office at New York, N. Y., U. S. A., July, 1918, under the Act of March 3rd, 1879.
Office of Publication, 1270 Broadway, New York, N. Y.

Issued Monthly
PRICE 25 CENTS
Domestic, $3.00 per year
Foreign, $3.50 per year

DECEMBER, 1919
Vol. 4 No. 12

A Merry Christmas to All Readers of "Motorship" and may the
... free from Strikes and Strife

Contents copyrighted 1919

MOTORSHIP

Trade Mark, Registered

149 CALIFORNIA STREET
SAN FRANCISCO

Head-Office:
1270 BROADWAY
NEW YORK, N. Y.

71 COLUMBIA STREET
SEATTLE, WASH.

PUBLISHED MONTHLY IN THE INTERESTS OF COMMERCIAL AND NAVAL MOTOR VESSELS AND FOR RECORDING INTERNATIONAL PROGRESS OF THE MARINE INTERNAL-COMBUSTION-ENGINE

President—MILLER FREEMAN

Published by MILLER FREEMAN & COMPANY
Advertising Manager—J. CHARLES RUIF

Manager—RUSSELL PALMER

Editor—THOS. ORCHARD LISLE
A. M. S. Naval Engineers. A. M. I. Marine Engineers

Subscription rates: U. S. A. and Mexico, $3.00 per year. Canada and foreign countries in the postal union, $3.50. Single copies, United States, 25c. Great Britain, 1/6. Other countries, 35c.
"Motorship" is published on the 25th of the month, and all changes in and new copies for advertising must be in the hands of the publisher prior to the 5th of each month. Notice of discontinuance of advertising must be given before the 1st of the month, preceding issuance.

Great Britain—James Selwyn & Co., 20 Essex St., Strand, London, W. C.
Australia—Gordon & Gotch, Sydney & Melbourne.

The oil-engined motorship has arrived! It is such a pronounced economy that it was bound to come. Nothing could stop it! And all obstacles have been removed as fast as they arose. The law of progress has seen to that. Very strong prejudices stood in the way of steam. But, one after another they were swept aside and steam reigned triumphant for a century. Steam now has had its day! Its zenith has passed, and gradually but surely it is being superseded by the economical internal-combustion power. Steamships are becoming decadent. America, the most important oil-producing country, is to be the greatest motorship-owning nation. Let us all co-operate and assist to make that day soon.

December, 1919 Vol. 4 No. 12

EDITORIAL

THE FUTURE OF AMERICAN SHIPPING

QUITE apart from Government construction and operation of merchant ships indications point to a splendid future for our mercantile marine if only shipowners will instal economical oil-engines. Already 118 freighters, tankers, fruit-carriers, motorships, etc., are under construction, aside from the Shipping Board's programme, and these include 14 ships aggregating 108,710 tons gross for the U. S. Steel Corporation now under construction at the Federal Shipbuilding Co.'s yard, Kearny, N. J., forming part of a new fleet of 250 vessels for the same owners.

Nevertheless, we maintain that if the demand for freight carrying-bottoms drops to any considerable extent, and if European and Japanese shipowners commence rate-cutting —a state of affairs which will come about within five years— it will be practically impossible for American shipowners to operate a huge fleet of oil-fired or coal-burning steamers against the competition of economical foreign motorships without heavy Government subsidies.

We have to remember that these European motorships sometimes have no fuel-bill whatever. A 10,000 ton Diesel-driven freighter loaded with paper-pulp, matches, iron-ore, etc., will come to New York on oil-fuel supplied from the bunkers of another motorship, bunker 1,000 tons of fuel-oil and load a general cargo; proceed to South America, discharge the general cargo and load coffee or rubber, etc., then she returns to Scandinavia and, in addition to unloading the cargo, will discharge between 400 and 500 tons of her bunker-oil and sell it locally or to another vessel. Sufficient money thus is realized to more than pay the cost of her own fuel, as she buys the oil in the U. S. A. for $10.50 to $14.00 per ton, while the price today at Christiania is 190 kroners per ton ($42.25) even for heavier oil suitable for firing boilers. So, even if the price of oil in three years time in Scandinavia is reduced by 50 per cent in accordance with the coming drop in transportation rates, the advantage still will be with the European motorships, especially as the American *steamers* will burn three times the amount of oil.

We have come to the conclusion that when serious competition for ocean-trade arrives, American shipowners will find it unprofitable to operate oil-fired steamers except on certain limited routes, and gradually such craft will be laid-up or sold to foreign buyers, with the result that less than ten years from now will see America's hopes of a great mercantile-marine shattered. The salvation of our merchant-marine rests with the economical Diesel-engined vessel, which at least can compete against foreign oil-fired and coal-burning steamers, and which will stand a much better chance against foreign motorships, as our own Diesel craft also can sell part of their bunker-oil when at a European port, and so operate without a fuel bill, which steamers cannot do.

OPERATING-ENGINEERS FOR MOTORSHIPS

ATTENTION of shipowners is drawn to that particular phase of the motorship-engineers question raised into the limelight by Mr. Hy. Schreck in our correspondence column last month, as it is a subject of sufficient importance to be given proper recognition. Mr. Schreck pointed out that the difficulty of obtaining good oil-engine operators is due to nearly all American motorships built to date being of small tonnage and that operating-engineers are paid accordingly. Consequently only the least experienced and youngest men accept jobs aboard small motorships and auxiliary sailing-vessels, with the result of the machinery not giving the reliability anticipated. Obviously this is false economy on the part of shipowners and is on a par with underpowering a vessel—the latter being the case with 90 per cent of the oil-engined ships now in service under

the American flag. With these two detergent factors, it is a wonder that any of our motorships have been a success.

From the first "Motorship" has urged shipowners to send two of their brightest steam engineers—almost as soon as they order a motorship—to the oil-engine builder's plant and let them "grow up" with the motors. Then, with the maker's guarantee-engineer, there will be an experienced oil-engineer on each watch when the ship goes to sea. After about three months the rest of the engine-room crew will have a reasonably good knowledge of the function of the new machinery, and the Chief-Engineer can go to the owner's next motorship and the second engineer be made Chief of the first motorship, and the third-engineer raised to second, and so on. In this manner quite a number of first-class motorship engineers can be quickly trained. "Motorship" also has urged that the money saved by the absence of firemen should be given to the engineers in the form of a bonus and so encourage them to take an interest and stick to their new jobs. It also will act as remuneration for the extra trouble to which the men are put when learning the various functions of oil-engines.

Another point—but which Mr. Schreck did not touch—is that these small motorships often attract the "waster" or a shady type of engineer who has difficulty in securing better-paid positions on large steamers, with the result that "graft" has entered into the operation of many American motorships. The method is, when at some small foreign port, to telegraph that "such and such a trouble" has developed, and that new parts must be made locally and fitted. The Captain, not knowing anything about oil-engines, must rely upon his engineers, so cables for or furnishes the necessary funds, and of course the engineers—sometimes working in collusion with a small repair shop on land—have a fine spree on shore and don't care how long the ship remains in harbor. We know of one case where the shipowners (a large oil company) unwittingly paid $15,000 for a "new crankshaft," but afterwards found that not so much as a bearing had burned out or a crack occurred. This is but one of many similar instances.

The solution is obviously to give this bonus, or to pay wages similar to those paid on a 10,000 ton steamer and thus attract a higher grade of operating-engineer to whom such practices are abhorrent and who is better qualified to handle motor machinery. The economies of a motorship are so many that this extra expense is extremely minor even with the running of a small motorship.

We have before us the case of a steam-engineer who has chief-engineer's certificate (unlimited tonnage) and who has overhauled the Diesel engines of one of the highest-powered motorships in the world. He desires to become an engineer on a motorship, but cannot get a certificate as engineer of any grade on a Diesel vessel, as the U. S. Local Inspector demands that he first puts in at least six months service on such a vessel. The Inspector, he claims, will not even accept several months' experience in the manufacturers' shops. On the other hand, a man who has been running a gasolene-engine in a 40 ft. work-boat can get at least a third assistant-engineer's license (unlimited tonnage) on a motorship. Obviously something is wrong and the rulings would seem to need radical revision.

U. S. GOVERNMENT'S MOTORSHIP PROGRAM

Shipping Board's Proposal to Construct 32 New Merchant Vessels

DURING the recent hearing before the House Committee on Merchant Marine and Fisheries at Washington, D. C., Mr. J. H. Rosseter, then Director of Operations of the U. S. Shipping Board, outlined his programme for new merchant ships to balance the Government's fleet. Altogether, he proposes to construct 172 vessels aggregating 1,466,000 tons d.w.c. at a total cost of $281,675,000, of which 120,000 tons are to be oil tankers. Of the cargo ships 32 are to be Diesel-driven, as follows:

	No. of Ships	Size of Vessel	Speed	Cost
	10	12,500 tons d.w.c.	13-14 knots.	$23,750,000.00
	10	10,000 tons d.w.c.	12-13 knots.	19,500,000.00
	12	4,500 tons d.w.c.	10 knots.	10,800,000.00
Total	32	27,000 tons d.w.c.		$54,050,000.00

It is to be sincerely hoped that Congress will sanction the construction of these motorships, as, when in service they will give American shipowners an excellent opportunity to study first-hand the economy and reliability of Diesel-driven vessels, and thus cause private interests to build large numbers of motorships and to convert their existing steamers. At the same time we must raise a protest against the installation of steam machinery in the ten oil-carrying tankers, for which service oil-engines are ideal, as a tanker is built to carry oil cargo, not to waste it up the smokestack.

THE HOUR OF ACTION

IT is the unfortunate duty of our public men and those entrusted with the execution of public trust that they are always expected to satisfy everybody. Usually, the more remote from party politics is the duty imposed, the easier it is for those responsible to perform their duties unhampered by political obstructionists.

Our federal Shipping Board has enjoyed the privilege of functioning with the hearty support of the entire country, and as it nears a reduction of its building affairs, there is a feeling that a new era has been started and a revival of the American merchant marine is assured. Perhaps the most promising indication for the future welfare of the country is the renewal of faith experienced by our financial interests in the conquest of foreign markets with hulls to carry their cargoes designed, built, classed, and insured in America.

There are two parties to this development—one is the seeker for a better, cheaper and more economical vessel, and the other is the producer who builds to the former's specifications. Usually the latter is under contract, with full responsibility as to the results produced. One depends on the other. We venture to say if the owner had asked for motorships five years ago there would now be American counterparts of Messrs. Schneider, Burmeister and Wain, Werkspoor, Götaverken, Sulzers, Vickers, Gio Ansaldo, etc., etc., to insure the adequate and permanent construction of "Noteworthy Economical Merchant Ships" of which we may be said to be destitute.

The engine builder cannot go ahead without financial assistance; the owner will not proceed without assurance of success. This the builder will give him, but at present—with a few exceptions—is unable to back up his faith with liberal contract terms for payment. The shipowner's superintendent-engineer, on whom the decision often rests, has until recently refused his unqualified support—perhaps afraid that he may ruin his reputation by hasty progress. Meanwhile, the progressive foreign shipowner has co-operated with his technical and shipbuilding resources, and the signal and repeated successes which they have won are almost disheartening to those of us in America who also believe, but are not with a deaf ear and a careless shrug from most of our own shipowners.

The time for Government aid or example is long over-due and though the horizon is clearing, there is much intensive construction and close co-operation needed by those who have the directing of the affairs of our Emergency Fleet.

It now seems to be almost the unanimous opinion of the technical experts that America can produce a reliable high-

powered Diesel engine. The economy that depends on that achievement should and cannot longer be ignored by the shipowner. He will shortly clamor for the delivery of marine Diesel-engined vessels. Let the Shipping Board and Congress show the way! They should grasp the opportunity before it is too late and complete their execution of a great duty by their wholehearted and merited support of the motorship.

We have a Senate Committee of Commerce, and a House Committee on Merchant Marine and Fisheries. There is a golden opportunity for every member of these two bodies to subscribe their united support to the cause of the motorship which will redound to their everlasting credit.

The war emergency is past and soon will be the usefulness of millions of deadweight tons of *steam*ships which have been delivered to the constituents of those in Congress to whom we have looked for a permanent merchant marine.

It is not the moment to start investigations or any time consuming red tape procedure. The Shipping Board and Emergency Fleet Corporation both are in possession of valuable data on motorship operation. There is real need to utilize money from the sale of steamers for the construction of a fleet of the most economical, reliable and modern cargo vessel developed to date—the motorship. Despite the waste of money that has occurred in our merchant shipbuilding the people of this nation still want an adequate merchant marine, and are willing to stand the slight additional taxation burden necessary to obtain a well-balanced fleet. Also, our wonderful shipbuilding facilities must not be disbanded now that we have profited by our errors. We must complete our great task, or forever be regarded as a "hot-air" nation.

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THE WORLD'S LARGEST BATTLESHIP AND THE WORLD'S GREATEST CITY

A striking picture of the U. S. "Idaho," and the business-section of New York City. This splendid ship was built by the New York Shipbuilding Corp. of Camden, N. J. Admiral-of-the-Fleet Lord Fisher Says: "Sink or scrap such ships as these and build Diesel-engined craft." Let America also build the finest merchant motorships. We can—and, by Heck, we will!

NOTEWORTHY ECONOMICAL MOTORSHIPS NO. 4—ERRATUM

With reference to the illustration of the motorship "Tisnaren," forming a supplement to our November issue it was stated that on her first voyage she averaged 11.5 knots for 23,877 nautical miles on a consumption of 2,611 tons of heavy oil. This was an error, as by referring to table on page 32 of the same issue it will be seen that the latter figure referred to the number of hours, the actual fuel-consumption being 1,261¼ tons, which, of course, is about half the amount we stated she consumed.

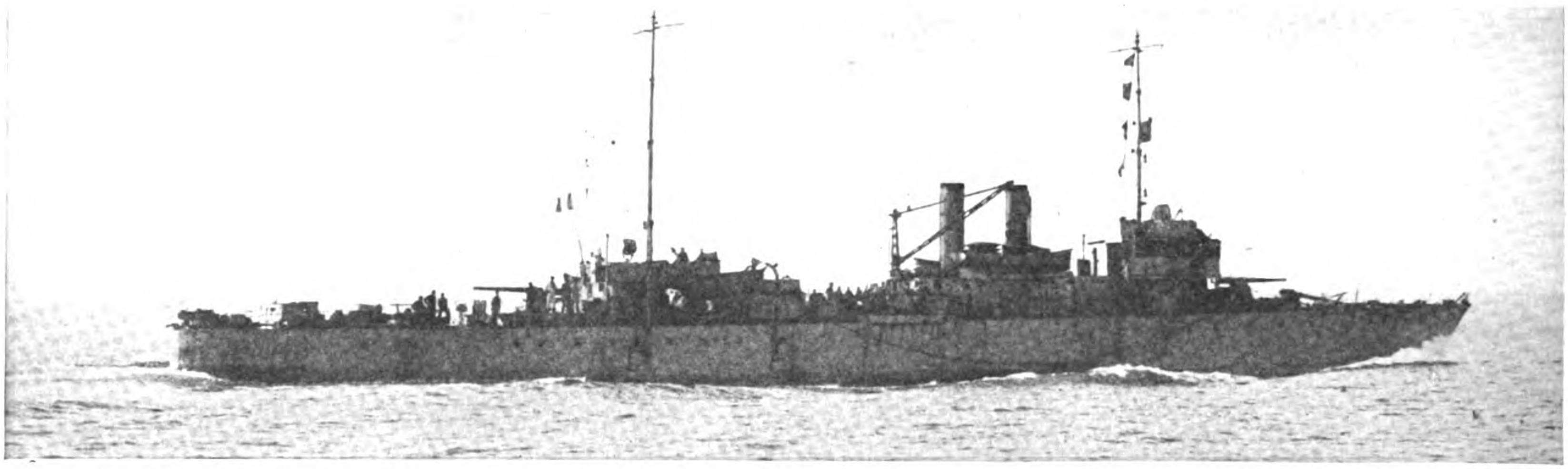
FORTY-EIGHT MILLION DOLLARS IN STEAMSHIP REPAIRS

According to "Fairplay" the United States Shipping Board has spent $48,000,000 on repairs to steam-driven vessels during this year—and some people say that motorships are unreliable!

OPINION OF THE JOHNSON LINE

The Aktiebolaget Nordstjernan of Stockholm, Sweden, who operate and own the Johnson Line of ocean-going motorships and steamships, advised us, during a recent call at their head offices in Stockholm, that they are more than pleased with their many motorships. They have in service eight Diesel-engined vessels of 6,550 tons d.w. and one of 9,200 tons d.w., in addition to sixteen steamers. Now under construction for them at the Götaverken shipyard, Göteberg, are two motorships of 9,200 tons d.w., and Burmeister & Wain of Copenhagen, Denmark, are building four motorships for them of 6,500 tons each. The latest motorships launched by the Götaverken for the Johnson Line has been named the 'Buenos Aires." She took the water on September 24th last.

It is interesting to note that steamships are entirely absent from their construction programme because, as the result of the operation of their eight existing motorships, they have pinned their entire faith to Diesel engine propulsion.



The twin-screw motor patrol-boat "Vaillante" propelled by Sulzer Diesel-engines aggregating 1,800 shaft H.P., and used for submarine chasing

Naval and Merchant Motorship and Oil-Engine Development in France

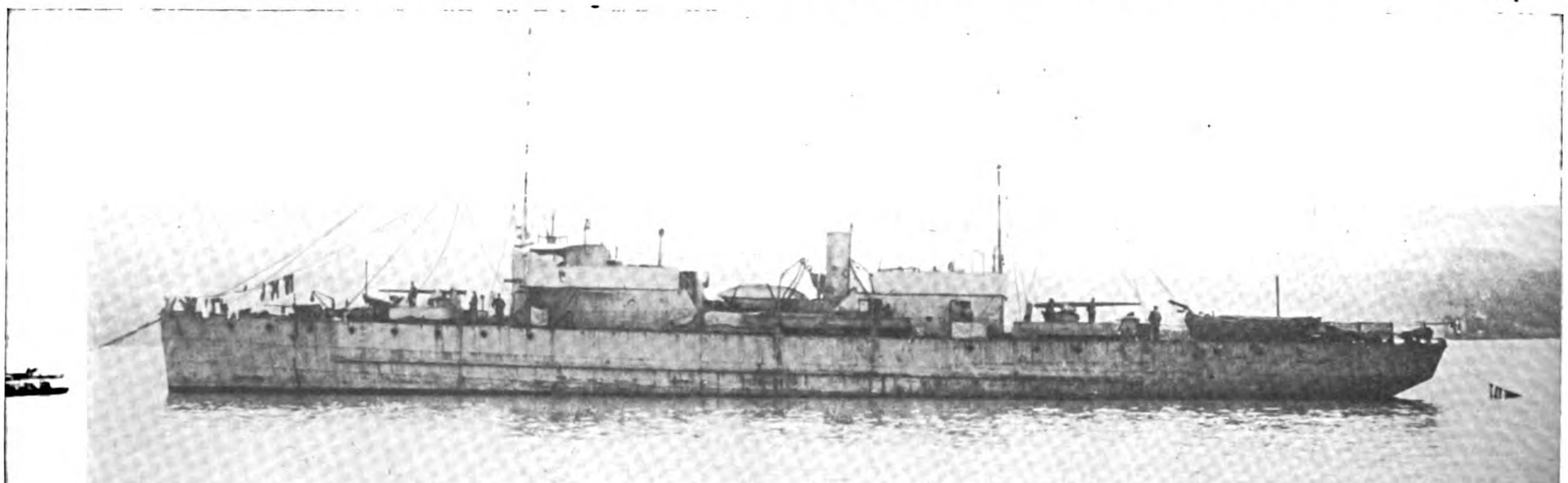
A Fleet of Motor Warships---Strong Encouragement Given to Diesel Engine Builders by French Ministry of Marine---Apathy of Shipowners Regardless of Government Subsidies for New Motorships That Last Two More Years

By the Editor of "MOTORSHIP"

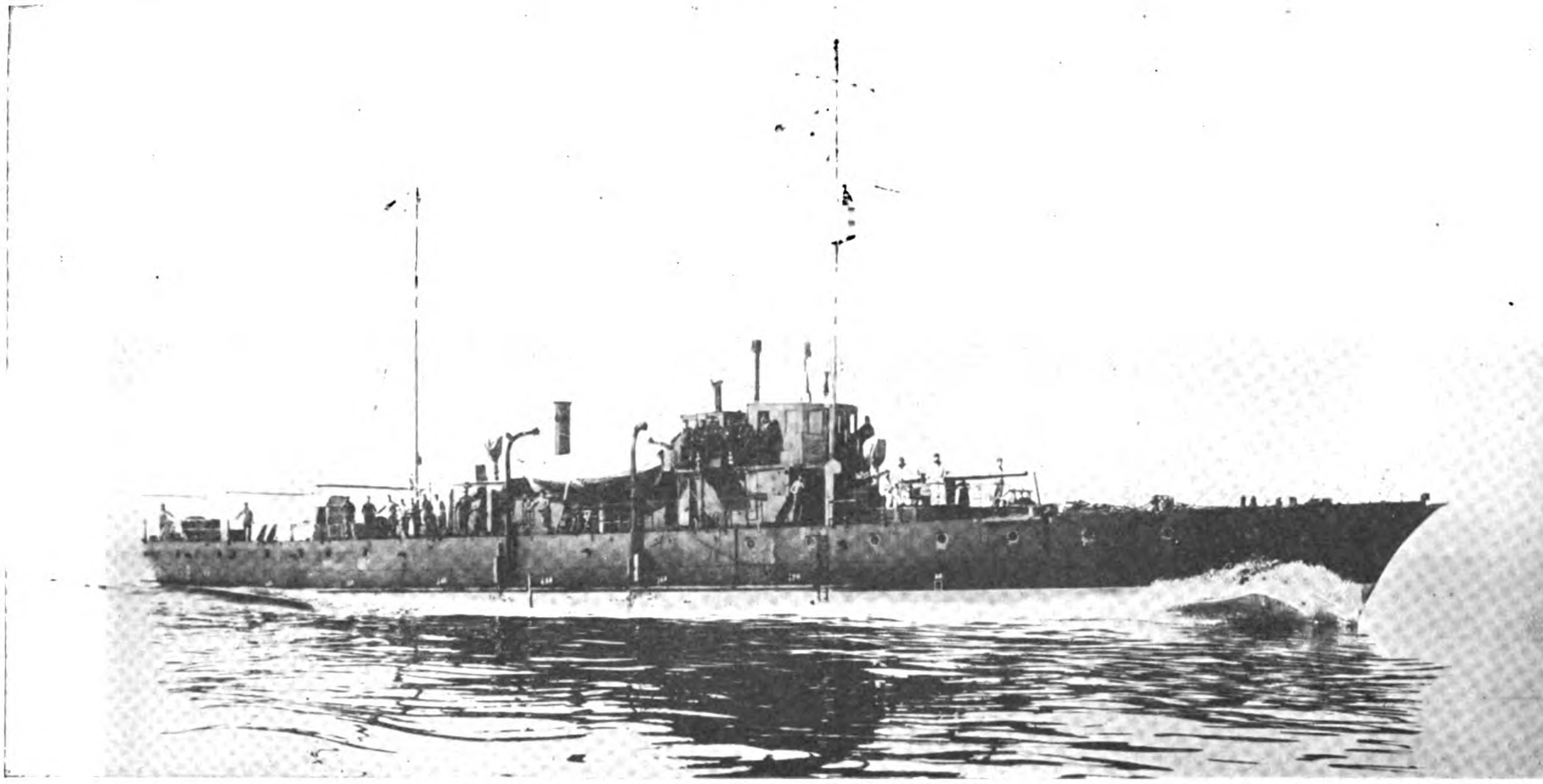
For certain reasons and owing to the mass of other European development matter on hand, much of which was published in our enlarged November issue, we have been obliged to hold back the publication of the following interesting revelations until now, although the material has been in our hands since we were in France last July. Nevertheless, most of the information will come as surprising news, as the same has not previously been published. This story is exclusive to "MOTORSHIP."

CESSATION of merchant shipbuilding in France during the war has greatly hampered extensive development of the heavy-oil internal-combustion marine engine. Nevertheless, up to the present time, practically nothing tangible has been done by private French shipowning companies to promote and encourage development and construction of the merchant motorship and its commercial oil-burning machinery, regardless of the shockingly high price and scarcity of bunker coal in France, especially during the last five years, and regardless of the fact that the Government gives handsome subsidies on the hulls and oil-engines of all commercial motorcraft built and powered in France from August 1, 1916, up to three years after the war. *Also a subsidy is given on all French-built hulls with American heavy-oil engines.* This apathy of the French shipowners during recent years has not been roused during the year following the armistice, and is very similar to that which existed among the majority of American, Federal and private shipping interests up to about twelve months ago, and which still exists among some of our most important shipowners. A few motorships of wooden construction have been built in America to the order of French shipowners, but these are of minor importance.

Had a little more foresight been shown prior to the war, shipowners of France would not have suffered by the shortage of bunker-coal during the last five years, which must have meant a loss of billions of francs. Had they a fleet of Diesel-driven cargo-carriers in service, those vessels could have loaded a six-month's bunker supply in their double-bottoms at any American or convenient foreign port where oil is cheap and plentiful, without encroaching upon the cargo space. A writer in an Italian shipping journal recently said: *"Where are France's motorships which would free her from the tyranny of British colliers?"* We are glad to see that twenty-two million dollars has been appropriated by the Chamber for the construction of motor-driven fishing vessels, so there should be an excellent market for American oil-engines in France. Furthermore, it was recently announced by Mons. Klotz, Minister of Finance, and by Mons. Claveille, Minister of Public Works, that $375,000,000.00 is to be spent by the French Government in constructing a new merchant fleet, if the bill is passed, the introduction of which was consented to by the Cabinet. Already it has been approved by the Chamber.



The 1,800 shaft H.P. Sulzer Diesel-engined French submarine-chaser "Conquerante"



The French submarine-chaser "Chiffonne," propelled by two 420 shaft H.P. Sulzer Diesel-engines

In the interests of France, let it be hoped that the most of this sum will be used for building motorships. Should sufficient internal-combustion heavy-oil engines be unobtainable in France, there are a dozen large marine Diesel-engine works in the U. S. A. which could supply the motors within twelve months, as well as many smaller concerns who could turn out the auxiliary machinery. We suggest that American oil-engine builders get into early communication with Commander Bricard at the French Ministry of Shipping, 65 Broadway, New York City. Since July last the import duty on oil entering France has been reduced to a level of that on bunker-coal.

There is a silver lining to every cloud, and thanks to the foresight of the Ministry of Marine, and to the enterprise of several naval shipbuilding and engineering companies, the Diesel oil-engine has not been entirely neglected in France; but it is high time French shipowners utilized the available naval experiences for commercial purposes. France is greatly indebted to Mons. Eugene Schneider, of the great armament firm of Schneider & Co. and its subsidiary companies for their courage in steadily plodding-away, experimenting and building marine Diesel-engines, and to-day this company has sufficient faith in the internal-combustion oil-engine to lay down eight 3,500 tons d.w.c. steel cargo-ship hulls, and to construct eight 1,500 b.h.p. Diesel motors for their own account at their Harfleur plant. In this they have shown a worthy example—not only to other French shipbuilders, but to American shipbuilders. Doubtless, they shortly will reap the advantage of their courage and foresight.

It was way back in 1912 that Schneider & Co. built and Diesel-engined the 10,500-tons displacement steel auxiliary sailing ship "France," which to-day is still the highest-powered and largest motor auxiliary-ship in the world. Her power is 2,400 i.h.p. in twin screws. Schneiders also built naval-type Diesel engines of 1,000, 1,500, and 2,500 b.h.p. at a time when other builders had not ventured beyond 900 b.h.p.

During the last fifteen years the French Ministry of Marine have spent extensive sums of money in encouraging the advancement of the marine Diesel engine and its construction in large powers, and it was a French submarine which was the first to be Diesel propelled. Also in 1911, when other navies did not possess a submarine of over 1,600 b.h.p., the French Navy placed in commission a Diesel-driven submersible of 5,000 b.h.p.; namely, the "Nereide," a Schneider production.

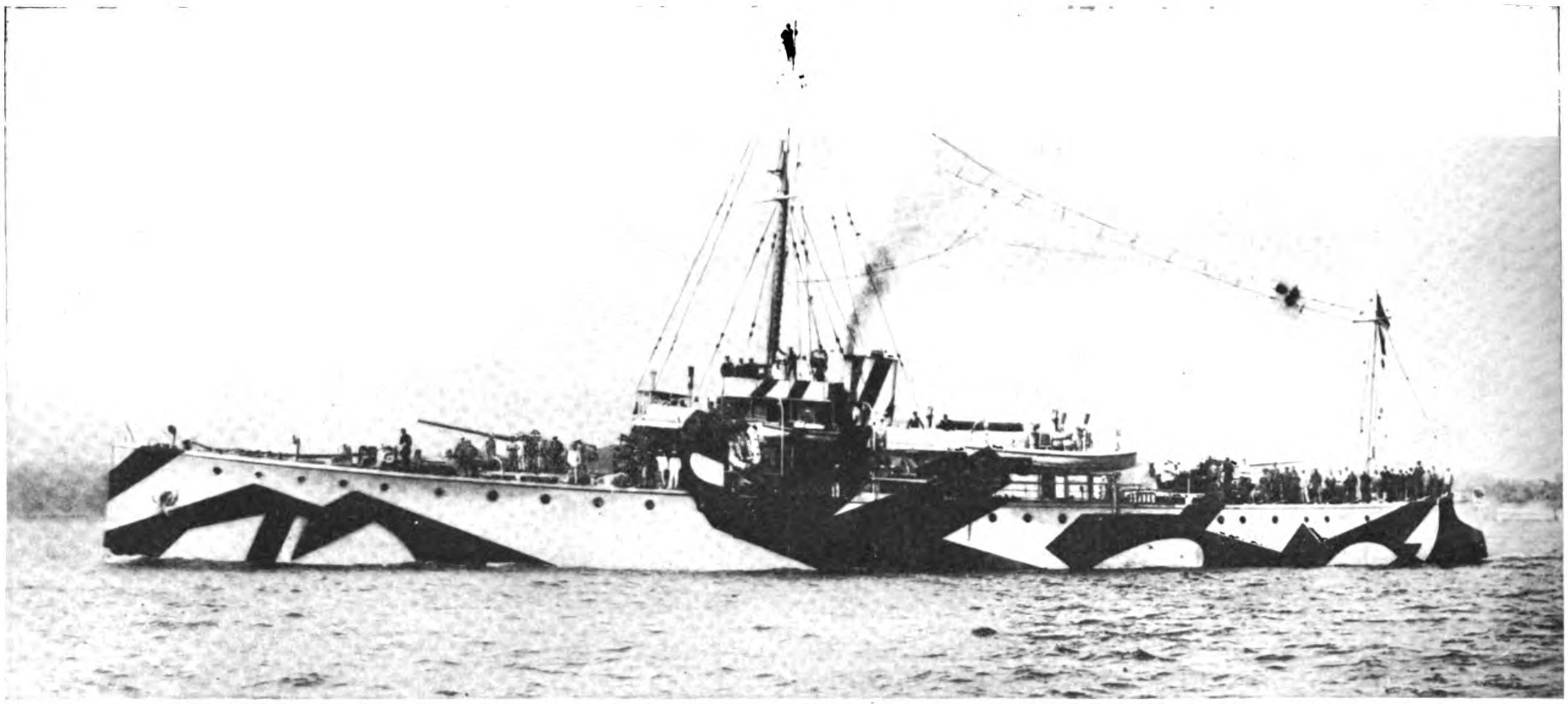
During the great war, when the German submarine became so dangerous, the French Ministry of Marine followed a policy that was advised and urged in the columns of "Motorship," and built a number of Diesel-engined motor-warships for submarine chasing and cargo-ship convoying, consisting of gunboats, sloops-of-war and patrol-vessels, many of which we illustrate. It was in September, 1918, that "Motorship" first announced the existence of these vessels, and we gave an illustration of one of them at that time by the courtesy of the Ministry of Marine.

Altogether there are a fleet of 34 craft, apart from the American-built 80 ft. and 110 ft. gasolene-engined patrol-boats purchased from Great Britain and the United States. Through the kindness of the Ministry of Marine in Paris, we are enabled to give exclusive publication of a list of these motor-warships, as follows:

List of French Diesel-Engined Warships

Name of Ship	Tonnage	Shaft Horsepower	Engine Speed	Class	No. of Engines per ship	Make of Diesel Engine
Ara..............	1236 tons	1650 h.p.	165	Sloop-of-War....	2	Polar
Leger............	535 tons	700 h.p.	200	Patrol-Vessel....	2	Polar
Conquerante......	450 tons	1800 h.p.	375	Gunboat........	2	Sulzer
Vaillante..........	450 tons	1800 h.p.	375	Gunboat........	2	Sulzer
Diligente.........	350 tons	900 h.p.	210	Gunboat........	2	Sulzer
Impatiente........	350 tons	900 h.p.	210	Gunboat........	2	Sulzer
Surveillante.......	350 tons	900 h.p.	210	Gunboat........	2	Sulzer
Bouffonne.........	350 tons	900 h.p.	210	Gunboat........	2	Sulzer
Friponne..........	350 tons	900 h.p.	210	Gunboat........	2	Sulzer
Engageanta.......	350 tons	900 h.p.	210	Gunboat........	2	Sulzer
Mignonne.........	350 tons	900 h.p.	210	Gunboat........	2	Sulzer
Chiffonne.........	350 tons	900 h.p.	210	Gunboat........	2	Sulzer
Onagre...........	470 tons	600 h.p.	450	Patrol-Vessel....	2	Sulzer
Caribou..........	470 tons	600 h.p.	450	Patrol-Vessel....	2	Sulzer
Eola.............	470 tons	440 h.p.	280	Patrol-Vessel....	2	Sulzer
Gardon...........	635 tons	500 h.p.	200	Patrol-Vessel....	1	Normand
Coujon...........	635 tons	500 h.p.	200	Patrol-Vessel....	1	Normand
Equille...........	635 tons	500 h.p.	200	Patrol-Vessel....	1	Normand
Lamproie.........	635 tons	500 h.p.	200	Patrol-Vessel....	1	Normand
Murene...........	635 tons	500 h.p.	200	Patrol-Vessel....	1	Normand
Campamule.......	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Clematite.........	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Jacinthe..........	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Jonquille..........	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Lavande..........	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Marjolaine........	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Paquerette........	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Perce-Neige.......	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Renoncule........	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Sauge............	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Tulipe............	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Violette...........	(Tonnage not available)	325 h.p.	450	Patrol-Vessel....	1	Fiat
Luronne..........	(Tonnage not available)	650 h.p.	450	Gunboat........	2	Fiat
Autruche.........	(Tonnage not available)	650 h.p.	450	Gunboat........	2	Fiat

The above gives a total of 20,896 shaft h.p. in 51 Diesel engines, of which five motors are



The 2,300 I.H.P. Polar Diesel-engined sloop-of-war "Ara" of the French Navy. She is of 1,236 tons displacement and carries two 6-in. guns

of the four-cycle type and 46 engines of the two-cycle type. In this article we presently will give further details of the five vessels fitted with Normand engines.

After a visit to one of the patrol-vessels in which two 420-450 b.h.p. Sulzer oil-engines are installed, a French engineer reported to the directors of his shipbuilding company that the craft had cruised between Marseilles and Bizerte for an average of 25 days per month for two years—a record unequalled by any of the steam-propelled patrols. These boats maintain a speed of 15 knots when at sea, only two men are on duty in the engine-room and many times these motor-vessels had to leave harbor within fifteen minutes of receiving orders. The captains say that manoeuvring is carried out with greater facility than with steam-machinery and that fewer repairs are required, also that the Diesel-engines have proved more reliable than any system of steam engines and boilers.

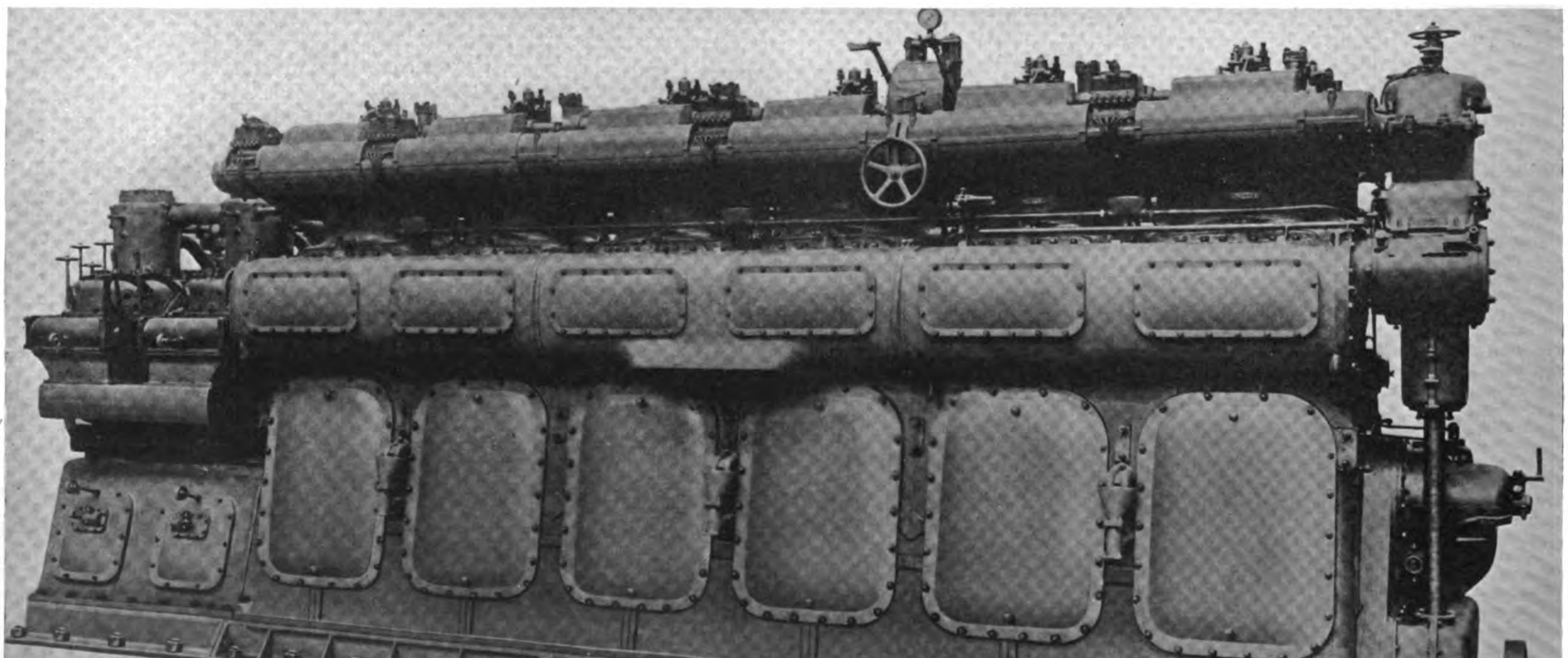
In addition to the above vessels, the French Admiralty purchased the 130-ft. patrol-vessel "Victoire," built by the Consolidated Shipbuilding Co. of New York City, and fitted with three 250 b.h.p. Speedway gasoline motors, but the armistice was declared before she was finished. Her speed is 18 knots.

The gunboat "Ara" originally was designed as a yacht and was built in England. She has the following dimensions:

Length O.A.	215'
Length B.P.	205' 0"
Breadth	31' 2"
Draught	13' 2"
Displacement	1236 tons.
Power	2300 i.h.p. (1650 shaft h.p.)
Engine Speed	165 R.P.M.
Ship's Speed	14 knots
Armament	Two 6" guns
Weight of all machinery	184 tons.

Her engines consist of two Polar-Diesel six-cylinder, 17¾-in. bore by 21¼-in. stroke, two-cycle sets, and on a 24-hour test showed a consumption of 0.480 lb. per shaft h.p. hour when developing 825 b.h.p., and a consumption of 0.485 lb. when developing 874 b.h.p. On board the ship this was reduced to 0.477 lb. with the two engines together developing 1,535 shaft h.p. The design of these engines is very similar to those originally installed in the motor tanker "Sebastian."

The scavenging-pumps are arranged directly below the main working-cylinders, thus providing one scavenging pump for each cylinder with a separate piston and piston-rod coupled in tandem with the working-piston, the suction and discharge of the air taking place on the bottom side of the piston, which also acts as an air-pump for starting purposes, compressed air being admitted below the piston instead of air at atmospheric pressure when it is acting as a scavenging pump. The pressure of starting-air used is from 50 lb. to 100 lb. per sq. in. The scavenging air is admitted to the working cylinders through the scaveng-



The 2,000 shaft H.P. Sulzer two-cycle Diesel type engine as installed in French submarines. Excepting the German engines, this is one of the highest-powered submarine oil engines in the world

The oil-engined motor patrol-boat "Gardon"

ing ports, which occupy one-half of the periphery of the cylinder, exhaust ports being on the same level around the other half of the periphery.

Three cast-iron columns are arranged in the back of the engine, each supporting two cylinders, and strongly bolted together, while at the front the columns are open and connected to the bedplate by forged pillars, so that the whole of the front of the engine is open except for the splash plates, which are fitted to the bedplate, and leave an open space below the bottom of the cylinders.

The "Ara" was placed in service in June, 1918, and during the whole period of arduous service not a moment's trouble was experienced with her engines.

Regarding the five patrol-vessels built by the firm of Augustin Normand of Havre, these craft were originally ordered by the Société Anonymé des Chalutiers pour le Grand Péche of Lille for the fishing trade, but were taken over by the Ministry of Marine while under construction. They have the following dimensions:

Length B.P.	45 metres
Breadth	7.60 "
Depth of Fore-deck	4.20 "
Draught at Stern	4.70 "
Bunker-capacity	188 cu. metres.
Displacement	650 tons.
Gross Carrying-capacity	320 tons.
Power (Single-Screw)	500 shaft h.p...
Loaded Speed	10.5 knots.

The Normand-Diesel engines of these craft have been working at full-power and at overload during the arduous duties of patrol work, and some of them ran for over 3,000 consecutive hours without any troubles.

In addition to the five four-cycle type engines of these boats, Messrs. Normand during the war have built *eight* two-cycle type submarine Diesel engines of 650 b.h.p. at 400 r.p.m., including for the latest type submarines, namely, the "Amarante" and the "Astree." Altogether eleven submarines have had Normand engines installed.

The Normand Diesel-engined patrol-boats "Equille" and "Lamproie" They were designed as trawlers

While writing about the 500 b.h.p. merchant-type engines of the trawlers, we may say that the exhaust-valves are of steel with cast-iron heads. They have all withstood heat and cold splendidly. Out of thirty, only one broke—due to its rod becoming jammed.

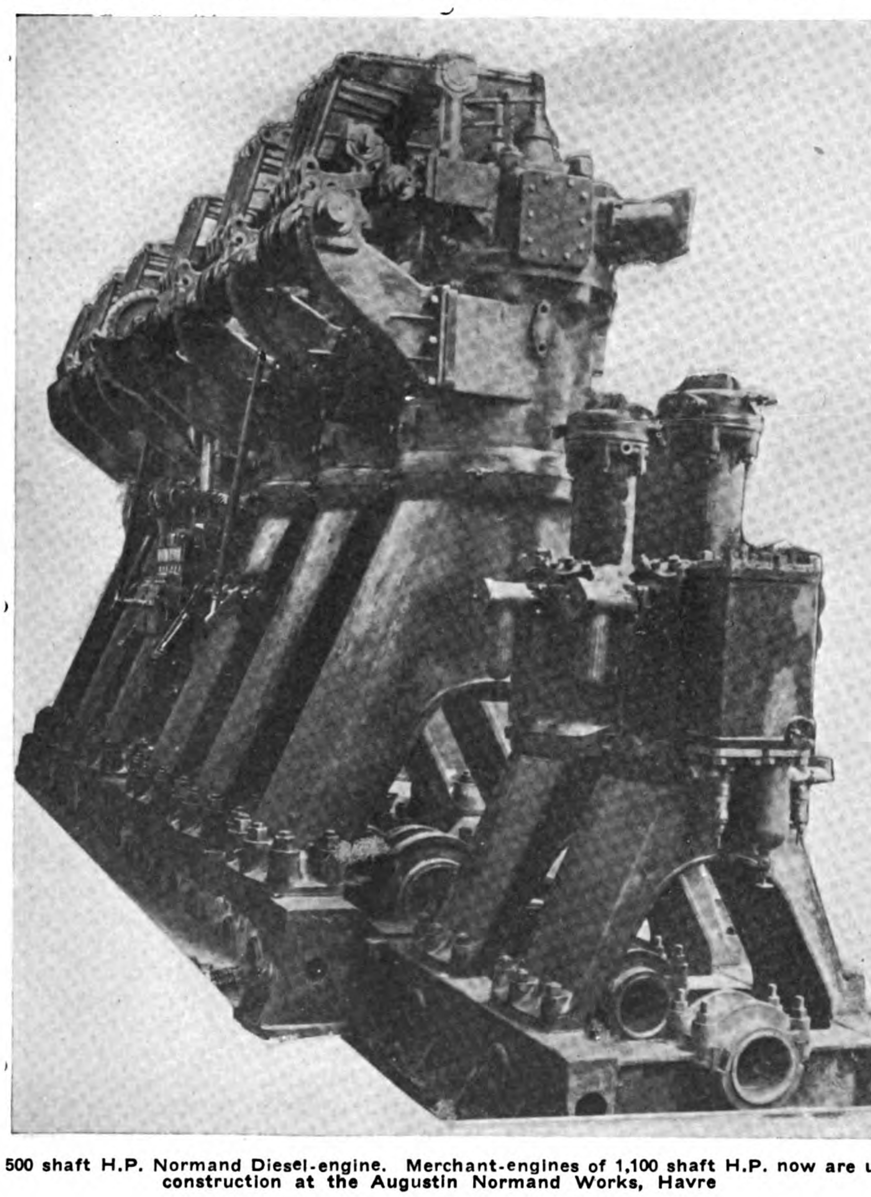
In consequence of the scarcity of steel air-reservoirs—of which so few were forged during the war—Normands used the cases of 340 shells which were rejected for defects that did not impair their tightness. Each motor required 3 groups of a capacity of 330 litres filled at a pressure of 60 kilos. With the special Normand design very little air is used in starting. The table given [Held over owing to pressure on space—*Editor*] shows the results obtained on the patrol-boat "Lamproie" by the Naval War Commission, which was present at the speed tests for a period of 6 hours at 200 revolutions when fully loaded, on the 10th of August, 1918. At the end of 6 hours at 10.4 knots, a series of stops was carried out, the re-starting for the purpose of reversing immediately following the stop.

The ship had a supply of 330 litres of air at 60 kilos pressure. The engine started 30 times successively with only 1,000 litres of air, and without having to refill the reservoirs, by means of the air-compressors. In working, the starting-reservoirs are filled very quickly by means of the compressors, which have a capacity three times as great as is needed for the injection of fuel, so that in reality the number of successive manoeuvres possible is about 50.

Normands have introduced some modifications into their present motors with respect to the lubrication of the big-end of the connecting-rod, as this was effected formerly by the lubricating-oil from the cylinder, which trickled into a groove and was carried into the hollow axis of the piston. They now use an oil conducting-pipe jointed on to the top of each rod, and fitted with airtight elbows; this pipe transmits to the bearings the oil that is under pressure by means of an oiler with visible outlets and multiple pumps. They have done this to avoid particles of carbon from the oily segments causing a possible heating of the piston-rod bearings. The lower part of this pipe consists of a pendulum, the movement of which is used for drawing diagrams.

As regards the new Normand merchant-marine Diesel engine of higher power, the construction of which they will soon begin, and which has eight cylinders of 540 mm. by 800 mm., they have designed a new mechanism for the inspection and withdrawal of the pistons from below. The pistons of this motor are sea-water cooled. Concentric elbows are used for the inlet and outlet of the water, the jointed arms being placed between the cylinders, and not at the level of the grooves which receive the oil which lubricates the pistons. The power of this motor will be 1,100 shaft h.p. at 130 revolutions from 8 cylinders.

About half-a-dozen important firms in France are constructing two-cycle Diesel en-

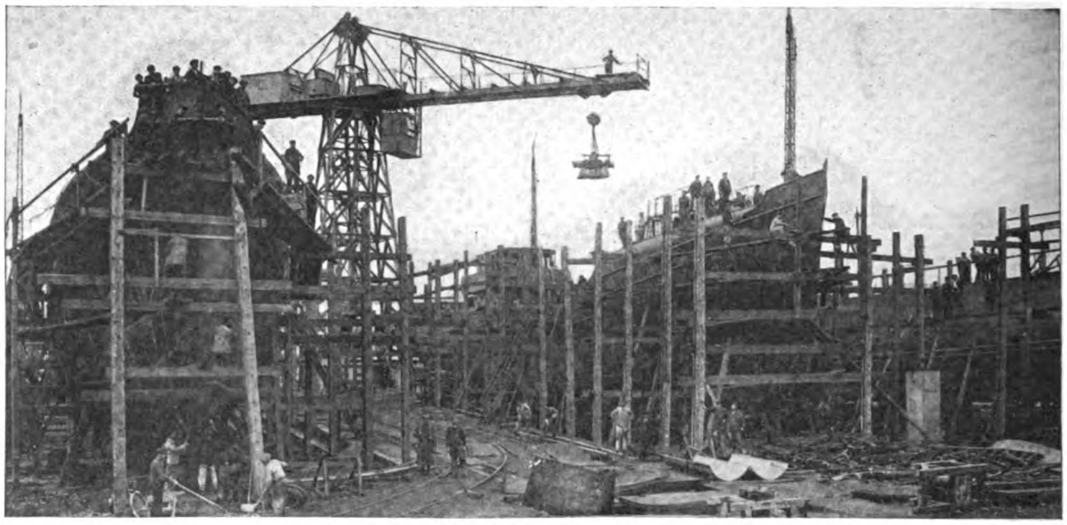


The 500 shaft H.P. Normand Diesel-engine. Merchant-engines of 1,100 shaft H.P. now are under construction at the Augustin Normand Works, Havre

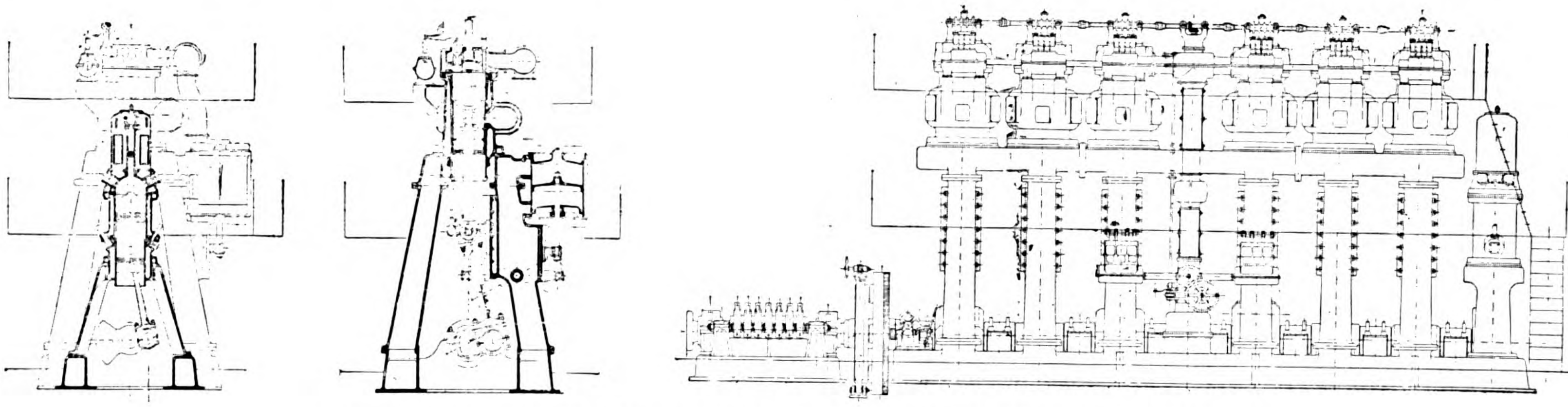
gines under Sulzer license, including the Société Anonymé des Forges & Chantiers de la Mediterranee, 25 Boulevard Malesharbes, Paris, with works and shipyards at Marseilles, La Seyne, and Le Havre. Their only merchant-ship Diesel engine construction to date has been for a cargo-boat, which had a four-cylinder 480 h.p. motor installed. But, they have built four Sulzer two-cycle type Diesels of 1,300 b.h.p. and four of 900 b.h.p. for submarines, and now are constructing a pair of 1,800 shaft h.p. (each) Diesels for the same purpose. However, they anticipate entering into more extensive commercial work very shortly. M. Moritz is the Engineering-Director, and Mr. Sonet Pastre, the Managing-Director.

A factory for building Sulzer two-cycle Diesel engines is being erected by the Compagnie de Construction Meccanique Procédes Sulzer, 12 Rue Boissy D'Anglas, Paris, and is expected to be in operation in the near future. Mr. Paul Hy. Ziegler is the technical-director.

Since 1908 the Société des Ateliers et Chantiers de la Loire, 11 bis Boulevard Haussmann, Paris, have been building marine Diesel engines at their St. Denis plant. The largest motors built by them were two 1,300 b.h.p.



Motor patrol-boats building at the Augustin Normand shipyard, Havre



General arrangement plans of the Schneider 1,500 shaft H.P. (2,000 I.H.P.) marine Diesel engine

six-cylinder sets of the two-cycle type for submarines. Owing to war-work the Diesel engine work has practically been suspended, but soon will be renewed.

They built a four-cycle Diesel motor of 300 b.h.p. in six-cylinders for the tug-boat "Chantloire" plying between Nantes & St. Lazaire, and some 50 h.p. stationary motors, one of which operated for 22 hours per day on tar-oil fuel, for several years during the war; while the tug-boat in question was overhauled for the first time after working 3,000 hours without trouble. This company also built *three* four-cycle Diesel engines of 420 b.h.p. each for submarines of the French Navy, and a 200 b.h.p. engine for their own power plant that has been running satisfactorily for 10 years. In 1910 they acquired a Nürnburg-Diesel license, and built six sets of twin 400 b.h.p. two-cycle motors for submarines. They now have a Sulzer-Diesel license.

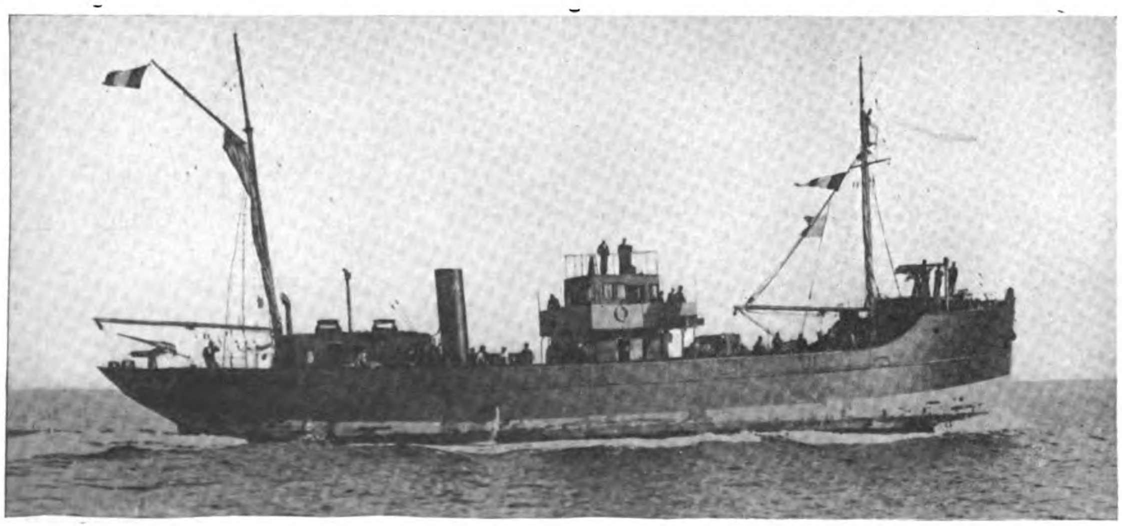
Until recently the Establissements de Materiel Naval & Industriel, 75 Boulevard Raspail, Paris, has only been acting as oil-engine agents and naval-architects and have fitted many barges and coastwise craft with internal-combustion motors, but they now are at work on the design and construction of a four-cylinder, four-cycle type marine Diesel engine of 400 b.h.p. at 175 r.p.m. This design we were privileged to see when in Paris. The cylinders have a bore of 400 mm. by 660 mm. stroke, and the fuel-consumption is to be 180 grams per b.h.p. hour.

It is of interest to recall the information previously given in the columns of "Motorship" that the Paris branch of the well-known American firm of Thompson Houston Co. are contemplating entering the marine Diesel engine field, having acquired a Tosi constructional license for that purpose. But, up to the time of our visit to their plant in France, no actual start had been made, although several millions of francs' worth of special machine tools have been purchased.

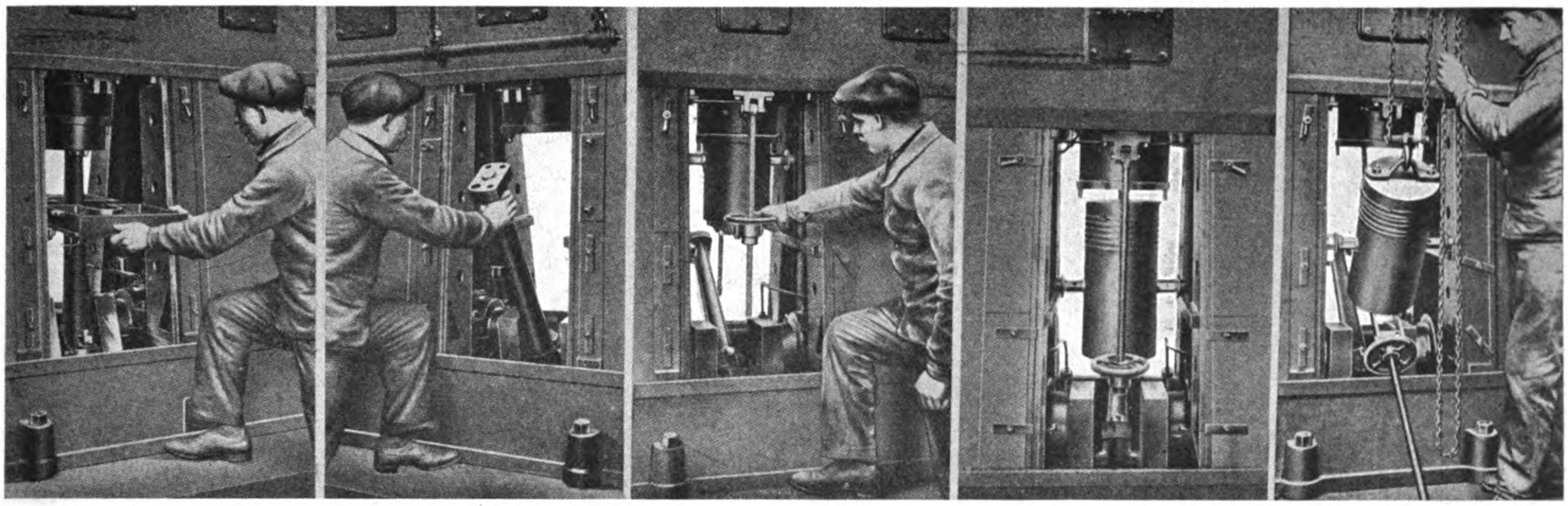
One of the most wide-awake engineering companies in France, namely, the Delauny-Belleville Co., have purchased the rights to build the B. & W. (Danish) marine Diesel-engine, and contemplate taking up its construction very actively; this we ascertained when at their plant at St. Denis-sur-Seine. On the bay of Pampin near La Pallice, their subsidiary company, the Compagnie General de Material Navale, is laying out a three-berth motorship-building yard. In addition Delauny Belleville are building a four-cycle merchant Diesel marine engine of their own design in sizes up to 500 b.h.p. They have not stopped there even, as for moderate powers they are manufacturing the Tuxham surface-ignition type marine oil-engine, having secured the French rights from the Maskinenfabrik Tuxham of Copenhagen. They also have a license to build the Sulzer two-cycle type Diesel engine. Their oil-engine work is under the direction of Mons. C. Radiguir, the General-Manager.

Prior to the war the Werkspoor-Diesel engine met with a very warm reception among French engineers, no fewer than four companies having purchased licenses. But the war period put a stop to all manufacturing. For instance, the plant of Dujardin & Co. at Lille was virtually destroyed by the Germans, and it will take some time before this firm can properly re-equip their shop and re-commence operations on an extensive scale. During the war their offices have been at 33 Rue d'Amsterdam, Paris, and their Paris works at 17 Rue des Terres au Curé, at Lille. Their plants are at 82 Rue Brate Maison and at Place Jacques Falmer, Lille.

The old-established firm of Brissonneau and



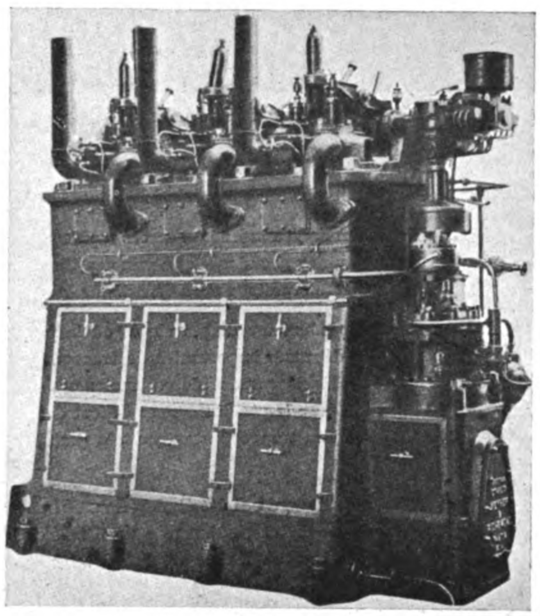
"Eole," a patrol-boat equipped with two Sulzer-Diesel engines of 220 shaft H.P. each



Method of removing a piston from the Werkspoor-Weyher & Richemond Diesel-engine

Lotz, 24 Rue de la Brassiere, Nantes, and of 8, Rue Laborde, Paris (Capital 1,650,000 francs) were another of the four French Werkspoor licenses, but we were advised by Monsieur E. Badier, that when hostilities broke out they were obliged to discontinue the construction of these engines, of which they had built a pair for stationary purposes. We understand that they may again take up its construction for marine work.

Weyher & Richemond, of 52 Route d'Aubervilliers, Pantin (Seine), also actively took up the construction of Werkspoor-Diesel marine-engines prior to 1913, and although they had not completed any marine sets, they control the patents for the new reversing mechanism now being adopted on the latest American and European motors of Werkspoor design, which was invented by an expert engineer from the parent plant while engaged in changing the Werkspoor design to suit French manufacturing and industrial conditions. Messrs. Weyher & Richemond have produced a nice-looking engine, which, while conforming in the main to many earlier Amsterdam productions, shows a certain amount of originality. We reproduced some interesting illustrations of this engine. Particularly noteworthy are the pictures depicting the patented method of removing the pistons from below. Like the American Skandia-Werkspoor design, the general construction of the engine shows a combination of cast-iron and steel columns, only it has no crossheads and guides, being of the trunk-piston type.



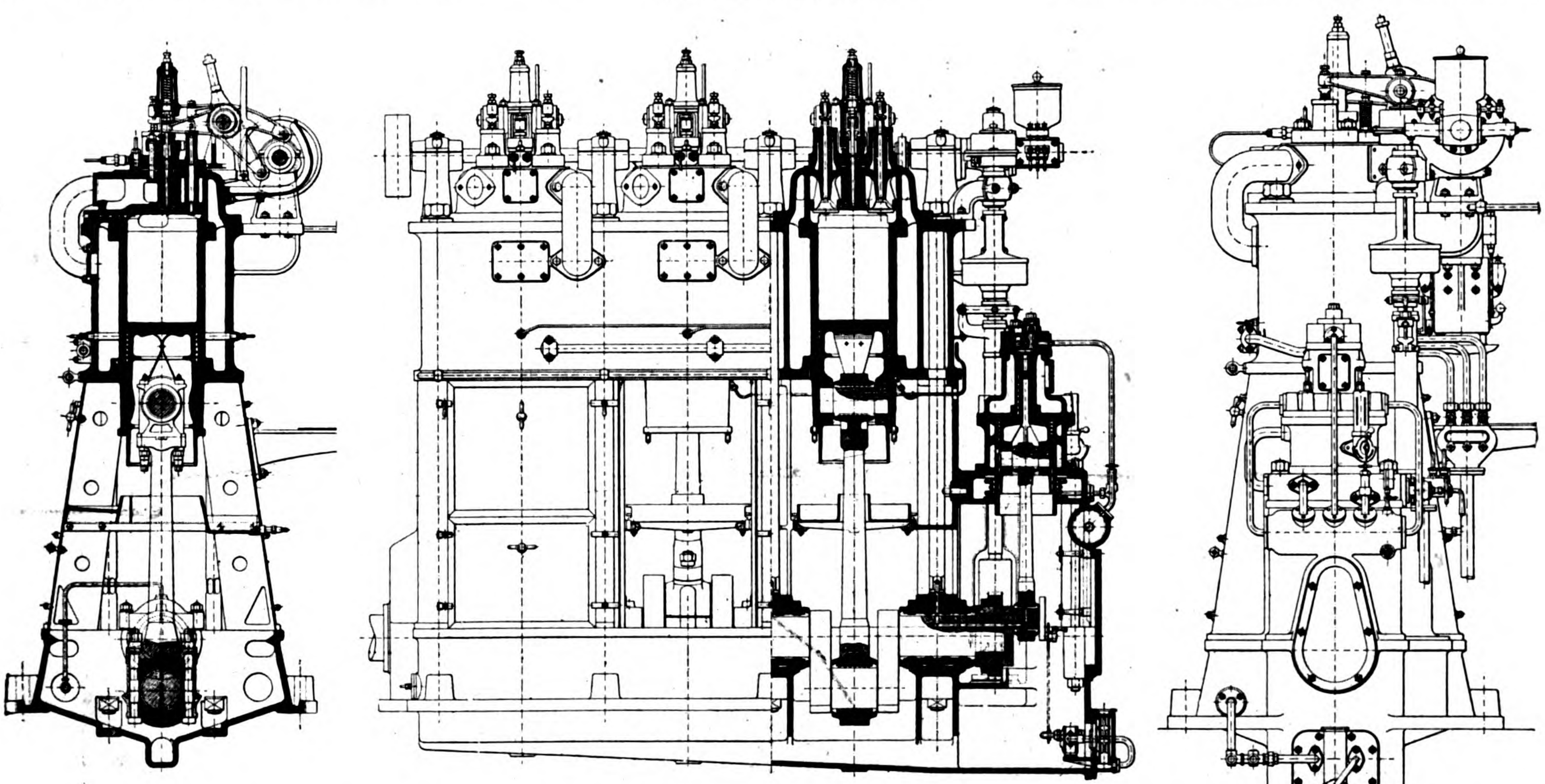
A three-cylinder four-cycle type Weyher & Richemond Werkspoor Diesel-engine

Also prior to the war, merchant motorship and Diesel engine construction under Werkspoor license was commenced by Chantiers et Ateliers de Saint Nazaire, of 6 bis rue Suber, Paris, and at their Penhoet Works, Saint Nazaire. They built, said Mr. J. Boistal, the general secretary, the motorship "Motrocine," a tanker of 5,200 tons gross, for the Société Naptha Transports. In this vessel two Werkspoor-Diesel engines of 1,150-1,300 indicated h.p. apiece at 130-140 r.p.m., were installed. This vessel has the following dimensions:

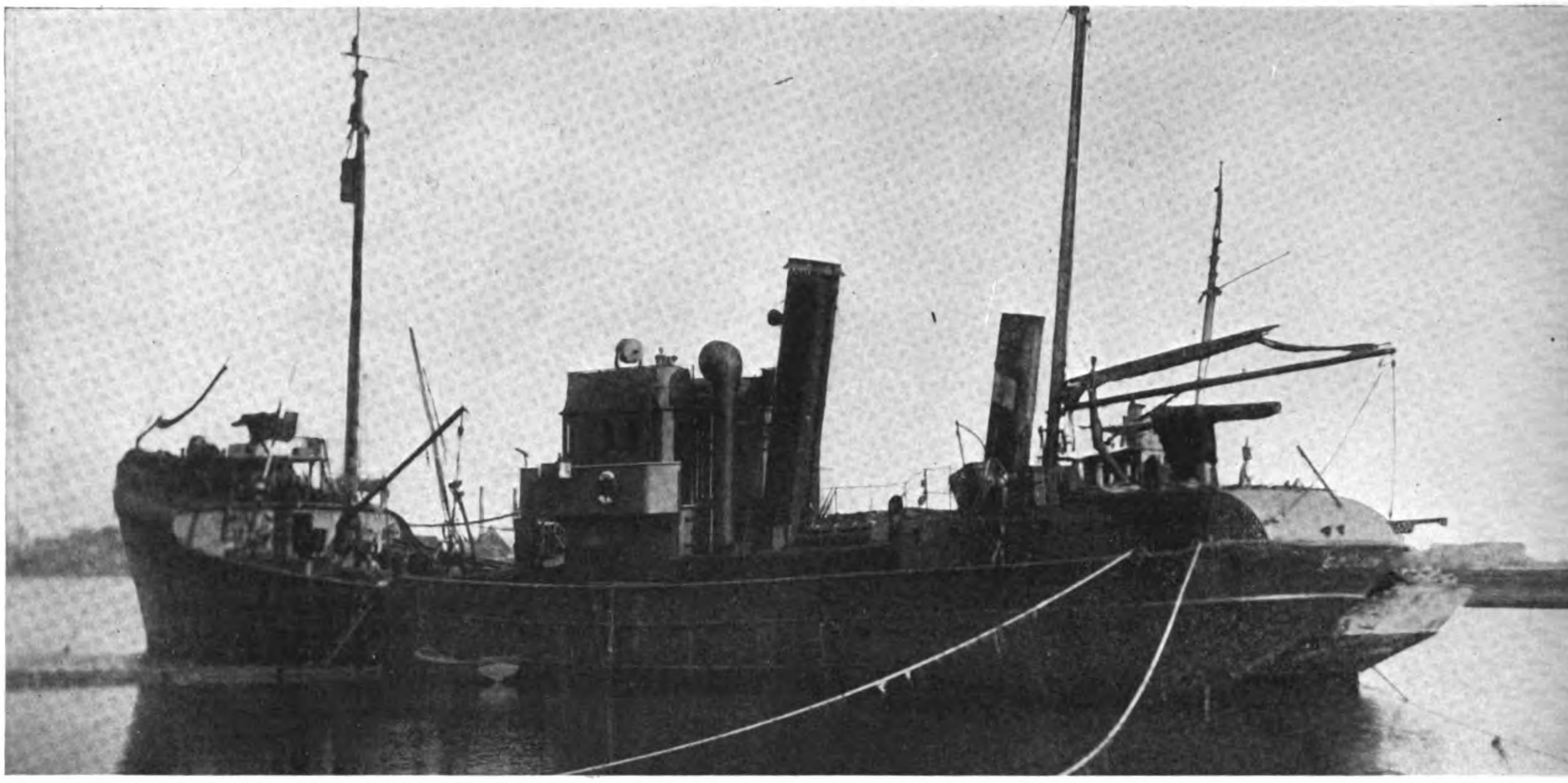
Length (b.p.)	350 ft. 0 in.
Breadth	46 ft. 0 in.
Draught	22 ft. 6 in.
Power (indicated)	2300-2600
Power (shaft)	1500-1700
Speed	10¾ knots

The "Motrocine" was placed in service a month or so prior to the outbreak of war, and is still in operation, having escaped the submarines. She has been a frequent visitor to Philadelphia, where she has loaded oil-cargo.

It is a source of regret to us that when in France we were unable to spare the time to

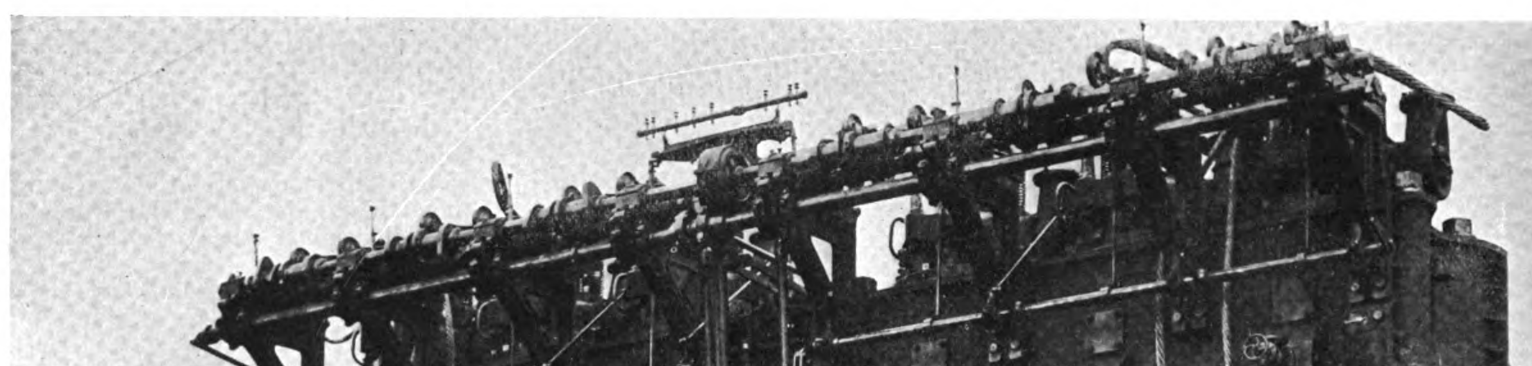


Section of the Werkspoor-Weyher & Richemond Diesel-engine. Note its similarity to the new Werkspoor-Skandia (American) marine Diesel-engine

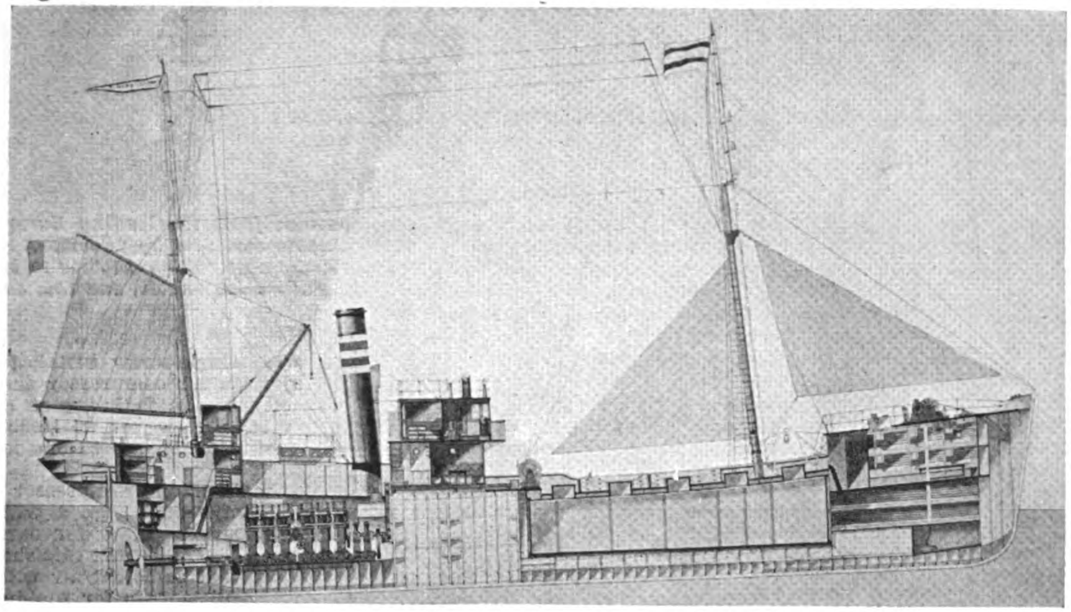


The 500 B.H.P. single-screw Normand Diesel-engined patrol-boat "Goujan"

make the journey to St. Etienne, where the Diesel-engine works of the Société des Moterus Chaleassiere are situated. This firm for many years has built the Sabathé engine—mostly for the French Navy—and have excellently equipped shops for the purpose. In a way one might term the Sabathé engine a "Super-Diesel," as it is a development of the Diesel principle, and we have often wondered why prospective American Diesel engine builders have not studied this engine with a view to its construction under license. **Drawings** and details were given on pages **5** and **6** in the April, **1917**, issue of "Motorship." Even with their high-speed naval motors very low



One of a pair of Werkspoor-Penhoet merchant-marine Diesel-engines built by the Chantiers St. Nazaire



Section of one of the Normand patrol-boats, originally designed as Diesel-engined trawlers

fuel-consumptions have been obtained, the 500 b.h.p. at 400 r.p.m. showing a consumption of 178 grams, or equivalent to 6.18 ounces (avoirdupois) per shaft h.p. Its noteworthy feature is that combustion is at both constant volume and constant pressure, there being two periods of injection. Cylinder compression is between 400 and 450 lbs. per sq. inch. Just before the piston reaches the top center, a portion of the fuel is injected by air and combustion occurs at constant-volume, increasing the pressure to 580-600 lbs., and almost immediately the maximum portion of the fuel-charge is injected and combustion continues at constant-pressure, as in the Diesel cycle. For details of the special double-lift fuel-valve, we would refer to the previous article on this engine, where a drawing of a section of the injection-valve was given.

As to what has been done in the way of marine engine construction at the Sabathé plant since 1914 we do not know, but we anticipate giving some details in the near future.

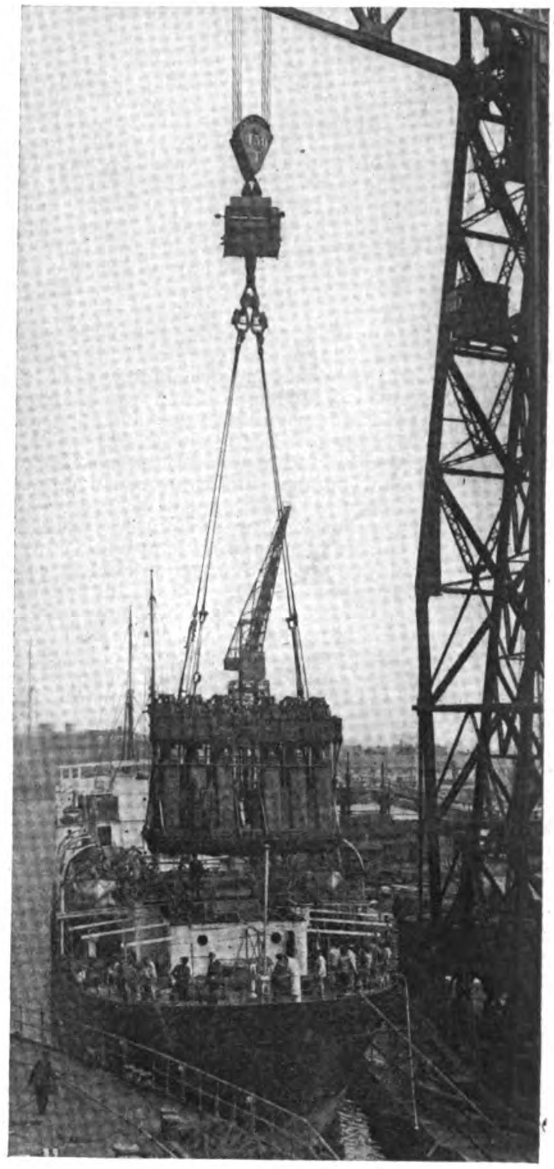
In addition to the Sulzer engines in the gunboats and patrol-craft, many Diesel motors of this make have been installed in French submarines, and we reproduce for the first time in America or elsewhere the Sulzer 2,000 b.h.p. six-cylinder, two-cycle type, direct-reversible, engine, of which a number are in service. Sulzer-Diesel engines of 1,500 b.h.p. also propel French submarines, and this latter model was pictured in our issue of June, 1918, being one of the many naval European secrets exclusively revealed by "Motorship" during the war.

The latest French motorship to have a Sulzer-Diesel engine as propelling power is the auxiliary sailing-ship "Clemenceau," built for the Cie France Atlantique, of Paris, and launched on October 11th of this year at the shipyard of the Société des Chantiers et Ateliers de St. Malo. She is of 1,500 tons d.w.c. and is the largest wooden vessel built on the Brittany coast. Her dimensions are as follows:

Length	185 ft. 0 in.
Breadth	37 ft. 4 in.
Depth	20 ft. 1 in.
Power	420 shaft H.P.
Propeller Speed	200 R.P.M.
Speed	8 knots
D. W. C.	1500 tons

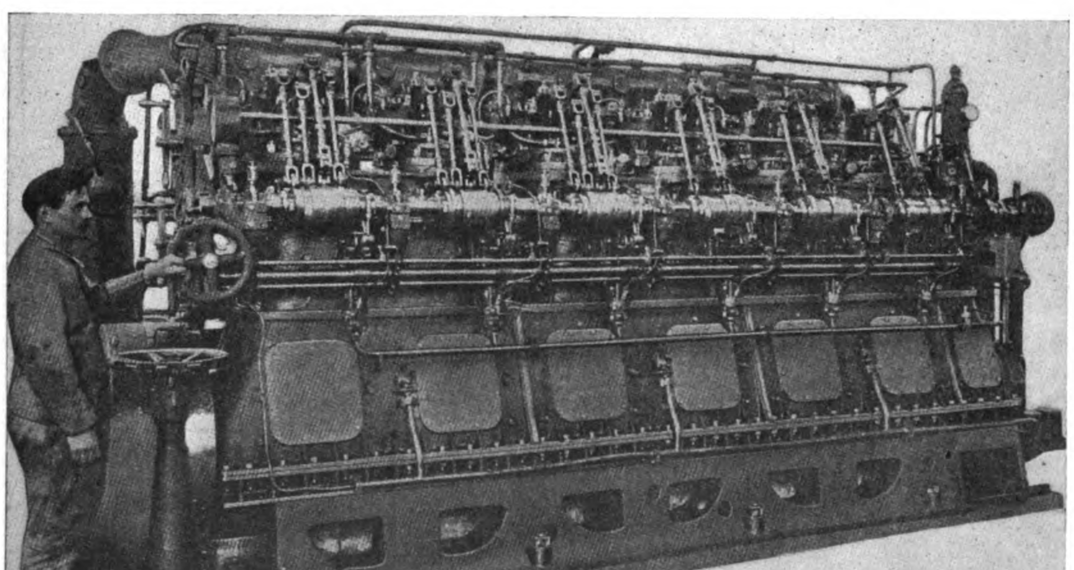
The owners have wisely installed sufficient power to drive her a reasonable speed at such times when her sails are not in use. Many American auxiliaries have proved failures purely because their owners failed to follow the advice given in the columns regarding installing adequate power. The engine of the "Clemenceau" is of the four-cylinder, two-cycle, direct-reversible type, and develops its rated power at 200 r.p.m., which is low enough to allow a good-sized propeller. The power is equivalent to 500 steam i.h.p. Up to October of last year about 35,000 b.h.p. in this model alone had been delivered from the Sulzer plant and placed in service, comprising about over 80 engines, illustrating what can be done with standardized model, and also showing the very large market for absorbing marine oil-engines of this power. The fuel-consumption of this engine is 0.45 lb. per shaft h.p. For the electric dynamos there is a Bolinder oil-engine imported from Sweden.

Regarding other motorship construction in France two oil-engined vessels—the "Marie Theresa" and the "Marie Guy"—were recently launched by the Society of Naval Construction of the South of France, for service on the Rhone, and three more motorships are to be laid down. In the recent shipping returns it was reported that there are now under con-



Installing Werkspoor-Penhoet Diesel engines in the French tanker "Motracine"

struction 21 oil-engined fishing-vessels aggregating 5,870 tons gross. This means an average of about 450 tons d.w.c. per boat. Surface-ignition engines are being instsalled in most of these fishing craft. On the canals of France the French Government has placed in service a number of motor tugs using tar-oil as fuel. Recently the Dutch oil-engined motorships "Princenhage V" and Princenhage VI," of 222 tons gross and 211 tons gross, respectively, were purchased by French shipowners. Finally it is of interest to mention that the manufacture of the Vickers-Petter marine surface-ignition oil-engine has been taken up in France by Motors Moreau, 26, Marbeuf, Paris. T. O. L.



The Sabathé 850 shaft H.P. naval-type "Super-Diesel" marine engine

Auxiliary Machinery of Diesel-Driven Vessels

A Practical Treatise on the Lay-Out of Engine-Rooms of Motorships

By Cosmos

When the Editor of "Motorship" was in Europe he was enabled to make arrangements for regular editorial contributions from the leading European writers and authorities on marine heavy-oil engines of both the Diesel and surface-ignition types. The first of this valuable series is by "Cosmos," who is an engineer of repute, holding an important position with a large British shipbuilding company. The aim of the publishers of "Motorship" is to be of the greatest possible service to the American nation, to its readers, and to the motorship and internal-combustion engine allied industries, and this series of articles is but one of the means whereby we constantly are improving the interest and value of this publication.

THE attractions of the Diesel engine, particularly in its form as a reversible prime mover applied to marine propulsion, has caused the necessary auxiliaries to be partially overlooked and in technical literature to be treated in too brief a manner. Even with steam machinery, it is often the case that the gain of one extra point in economy is diligently sought in the main engine, whereas relatively large losses with the auxiliary machinery are neglected.

Increase of efficiency of fuel consumption of the auxiliary machinery with steam installations is still possible, and would effect considerable improvement in overall consumption.

It is with the Diesel-driven ship that the present article deals. It is perhaps necessary in this case to define exactly those units that are considered as auxiliaries. Amongst the most important parts of the whole plant are undoubtedly the fuel pumps for supplying the fuel to the working cylinders, and the multi-stage air-compressor delivering the air required for injecting the fuel into the main cylinders of the normal Diesel engine. These might be regarded as integral parts of the main engine, or as auxiliaries. The fuel oil pumps and the fan in oil-fired forced-draught boilers are always treated as auxiliaries. There is, however, the difference that steam is an elastic fluid and the regulation of the steam engine is not carried out by the regulation of the boiler fuel-oil pumps and the forced draught fan, although these are properly adjusted as required to suit the speed and power output of the engine. With the Diesel engine, control is effected by and governing takes effect on the fuel-injection pumps, the compressor output being suitably regulated by hand to give the best conditions of combustion for the power required.

The Diesel engine is started by supplying power from an outside source, and when started is controlled by the fuel pumps, so that its manipulation is much facilitated by these pumps being driven from the main engine itself. In no case has a Diesel engine been built with separate driven, fuel-injection pumps. In the case of the air compressor, the Diesel engine requires for fuel injection approximately the same quality of air per revolution irrespective of the speed or the power. This is merely an approximate law, but when the compressor is driven from the main engine this law is satisfied. It can be stated that if the compressor is suitable in size and capacity for full power, it will not fail to deliver sufficient air for slow running. The slower the speed the lower the pressure required for injection.

Many marine installations have had this compressor separately driven; generally fitted in duplicate. The reasons for the adoption of this plan are several—increased reliability since the failure of one compressor in any way does not entail the stopping of the main engine. From a given size of main engine cylinder, a greater power output at the propeller could be obtained with separately driven compressors, since in computing brake horse-power, the power to drive the compressor is not to be deducted from the indicated horse-power. A shorter main engine results than in those cases where the main engine compressor, as is general practice, is driven from the forward end of the main crankshaft.

On the other hand, the disadvantages are increased weight, space occupied (except in so far as length of engine is concerned), cost, and fuel consumption, since the small prime mover driving the compressor will not be so efficient in fuel consumption per unit power as the main engine; increased complication of piping arrangements to supply cooling water, lubricating oil, etc. (all of which are taken from the main engine supply when the compressor is direct driven), and the supply of air to suit the main engine conditions is not so automatically regulated.

To emphasize this latter point, suppose that slow speed is suddenly demanded of the main engine, unless the separately driven compressor is immediately either slowed down, throttled, or a portion of the supply directed elsewhere, the fuel injection air pressure will rapidly rise to the relief valve pressure.

With reduced revolutions, lower pressures of injection are desirable to avoid misfiring, caused by the excess quantity of air forced into the cylinder by the high pressure.

It is considered that it is better practice for the fuel-injection air-compressor to be an integral part of the main engine and to be direct driven. It can be stated that this is becoming even more general practice than hitherto.

Considering both the cooling water and the forced lubricating pumps, the same arguments can in general be applied. If separately driven, the cooling water pump delivery required to be equated by hand regulation to the requirements of the engine, to prevent delivering too much water when running at reduced power, and so overcooling the engine and conversely.

With forced lubrication Diesel engines, it is probable that the wear-down of bearings is occasioned by the rubbing contact, to which these surfaces are subject after the engine has started until the main engine driven lubricating oil pump has picked up its suction, and works at the normal pressure.

A suitable remedy is to fit a standby pump for starting-up and when manoeuvring to insure that all the bearings will be flooded with oil before starting, and that the system will be charged at working pressure during every revolution. In any case the fitting of a stand-by pump is a rational precaution, against the breakdown of the main forced lubrication pump.

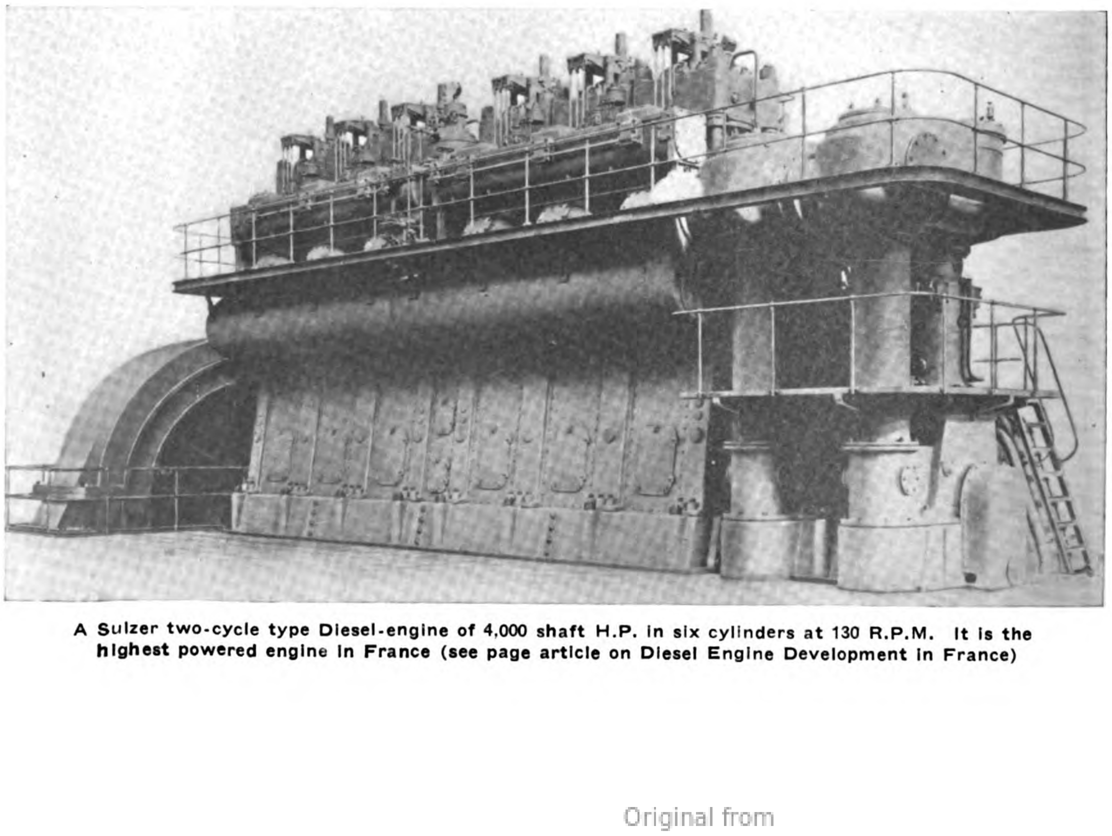
It might be urged that too much attention in these remarks and recommendations has been given to the question of manoeuvring conditions which only at most operate, with any marine engine, for a very small percentage of the total running time. It can be shown, however, that it is just in this phase of marine work that there is difficulty with the Diesel engine, which cannot compete in flexibility with prime movers actuated by the elastic fluid steam. With many marine engineers the fear of lack of flexibility acts as a deterrent to the adoption of the Diesel engine.

Too great attention, therefore, cannot be paid to such a vital matter, even at the expense of some duplication, incurring the risk of a certain degree of complication.

Assuming then that the main engine is complete as regards its fuel-injection pumps, fuel-injection air-compressor, lubricating-oil and cooling-water pump or pumps, these latter depend in number, according to whether the pistons are fresh, salt water or lubricating-oil cooled. There still remains a considerable number of auxiliary engines. The Classification Societies require that an auxiliary compresor must be fitted to act as a stand-by for the main-engine compressor and to enable bottles to be charged with air in order to give ample manoeuvring capacity. Lloyds regulations require that with single-screw installations the auxiliary fuel-injection air compressor should be of half the capacity of the main-engine compressor, and with a twin-screw set of sufficient capacity to supply fuel-injection air to one main engine.

In the case of the main-engine compressor the output capacity will always be designed with a margin over the bare figure required for normal full-power working. It is desirable that this should be so in order to insure that sufficient air will be delivered to meet the requirements for fuel-injection even when the compressor output has fallen slightly below the normal, due to one cause or another, such, for instance, as when on account of bearings wearing down the compression or the clearance space is larger than the design figure and the output is diminished on account of the capacity lost by the re-expansion of the greater amount of clearance air; or when the valves leak due to dirt or pitting on the seat; or when leakages are taking place in the deliveries from one or more stages. It must also be foreseen that thick oils require higher injection pressure and more air than thinner oils, and this contingency must be allowed for. A warning note should be sounded that this margin of capacity in compressors should be a minimum rather than a maximum. Too great a margin means that the mechanical efficiency of the main engine is impaired by requiring to drive round a larger machine than is absolutely necessary. After the starting air reservoirs have been filled, an excessively proportioned compressor must be throttled down to prevent the delivery pressure from rising too high for the satisfactory injection of the fuel. Such throttling again increases the load on the main engine in that the suction stroke absorbs more power to overcome the resistance due to throttling, and further increases the number of compressions to be carried out in the low pressure stage, with the consequence that the temperature range in this stage is also greater and the L. P. delivery temperature increased. The higher the temperature the greater the chance of carbonization of the lubricating oil and consequent damage to the valves and seats.

Lloyds requirements for single-screw vessels is that the auxiliary compressor is to be of such a capacity that it is able to keep the main engine running, although perhaps at reduced revolutions and power. With twin screw installations quite a small auxiliary will serve to keep one of the main engines running at reduced speed and power, particularly if arrangements are provided on the main engine to the end that it can be run on a reduced number of cylinders, or that the amount of opening of the cylinder fuel-injection valves can be reduced at low power so not to give opportunity of



A Sulzer two-cycle type Diesel-engine of 4,000 shaft H.P. in six cylinders at 130 R.P.M. It is the highest powered engine in France (see page article on Diesel Engine Development in France)

needless expansion of compressed-air into the cylinder. In the case of twin-screw installations it is doubtful whether such a provision is really necessary. If each main-engine compressor has the margin normally provided, quite a small auxiliary should suffice to meet all reasonable contingencies. It is also necessary to make such arrangements that compressed-air can be generated if, due to any cause, all the air in all the reservoirs in the ship be lost. In those Diesel ships fitted with all electric auxiliaries and no steam-boiler, unless some such provision were made and all the air were lost, it would be impossible to start either the auxiliary or the main oil engines until compressed-air from shore or some separate source was obtained. To cope with such a possibility, either a small compressor, steam or hand operated, or driven by a Diesel, surface-ignition, or kerosene engine that can be hand started, is generally installed.

These are the leading considerations concerning the compressors which are perhaps the principal auxiliaries.

As already explained, an auxiliary forced-lubrication pump is desirable, and connections should be provided from the ballast or other pump, so that in the event of the main cooling-water pump breaking down, a suitable service of water can be maintained. Pumps will be required for handling the fuel-oil consumed by the engines, either to draw from the ship's tanks or double bottom, and to deliver to the ready use or settling tanks (when water and impurities can be allowed to separate out this operation being facilitated by the provision of heating coils in these tanks), from which the main engine fuel injection pumps draw.

For ships' use there are the ballast-pump, bilge and sanitary pumps, electric-light engine, generally situated in the engine-room. Power for the capstan, steering-gear, windlass, winches and whistle also has to be legislated for.

In general, how should these auxiliaries be driven? Early steam practice was to crowd on to the reciprocating steam-engine as many auxiliaries as possible, with a view to coal economy and first cost, this method being obviously the cheapest to build, and is the more economical in fuel-oil, since the small separate engines are notably "steam eaters." With the advent of turbine machinery, naval practice of having the auxiliaries separately driven was resorted to, since the high-speed rotary motion of the turbine little suited the low-speed reciprocating auxiliary engines, and furthermore the auxiliaries assumed with turbine machinery greater importance than with the reciprocator. With Diesel work, the problem as to whether or not the auxiliaries should be separately driven has been attacked *de novo*, and each case is treated on its own merits, that solution which makes for the highest reliability and facility of operation should be adopted, and recommendations in this direction have been made herein.

The next point is as to whether compressed-air, steam or electricity should supply the power for driving these separate auxiliaries. To dispose of the case of the first named, compressed-air driving might be thought to be the most suitable since compressed-air must be generated, and stored in any case for fuel-injection and starting. In a few instances this system, alternatively with steam, has been tried for the steering-engine and some pumps, and has been found extremely extravagant. It should, however, be pointed out that the engines in which the air was used were designed for steam, and had the valve-gear, glands, etc., been of a type suitable for compressed-air, and had ample provision been made for pre-heating the air before use, the results might have been improved upon, although it is an extremely difficult matter to maintain a compressed-air operated motor in an efficient state, due to the moisture in the air, especially when its use is intermittent, such as ships' pumps or irregular, as in the case of the steering-gear.

Steam driving from an oil-fired donkey-boiler has been the favorite solution. A small donkey-boiler has almost always to be installed, if only for heating the ship. Electric heating, although clean, is costly in current consumption. Steam auxiliaries are low in first cost and are a known quantity, confining thus those features that may be novel in the experience of the operating engineers to the main engines. Steam is very suitable for winches, the capstan and the whistle.

An interesting detail concerning whistle operation is the disadvantage sometimes cited against electric or air whistles in that with the steam-whistle navigators of ships in the vicinity can tell, if more than one ship is in question, which of the ships is signalling from the "feather" of steam issuing from the steam-operated whistle. With the air or electric siren no such indication is given. At one time it was thought that steam was the only safe medium for the operation of such a vital machine as the steering gear. The success, however, of the electric hydraulic system with steam and Diesel ships has completely dispelled these doubts.

When steam is the motive power for auxiliary driving the provision of a special small, hand or hand-started engine-driven compressor, as already mentioned, is, of course, unnecessary.

Steam-driven auxiliaries are, however, illogical. If the main object of fitting marine Diesel engines is economy—primarily economy of fuel—then it is surely a retrograde step to negative a certain considerable part of this saving in fuel by fitting steam auxiliaries, although to some extent the extra consumption is balanced by the lower first cost of the steam plant.

The most attractive solution is the electric drive for auxiliaries. Diesel generators in the engine-room provide current for electric motor driven auxiliaries. This system gives remarkable fuel economies over the steam drive, against which must be set the high first cost, and, to some extent, the electrical complications. Nor have electric motors in marine plants been totally immune from trouble. With the maximum degree of unification and standardization so far as possible of powers of electric motors on board, couplings, bolting, etc., the carrying of a few spares should render the installation entirely reliable in operation.

The advances in this direction which have been made within recent years make it possible to affirm that there is no great difficulty in designing and installing a complete electrically-driven auxiliary equipment that will operate at sea in an entirely satisfactory manner. Unsuitable capacity of auxiliaries will militate against success and is in itself an important subject, which will be dealt with in detail subsequently.

As with the main engines and with the auxiliary machinery, considerations of first cost must be balanced against running economy. All advocates of the Diesel system must plead for the long view and lay the maximum stress upon reduced running expenses.

New 1500 I.H.P. Neptune Merchant-Ship Diesel Engine

British Two-Cycle Principle Motor of The Stepped-Piston Type

By the Editor of "Motorship"

THERE are a limited number of British firms who did not defer action until the perfection of the high-powered marine heavy-oil engine had been brought about, but who from the earliest days consistently "plugged-away" with its development and production. Among these companies may be mentioned that of Swan, Hunter and Wigham Richardson, Ltd., Neptune Works, Newcastle-on-Tyne, England, who prior to the war secured a license from the Polar-Diesel Co. of Stockholm, Sweden, installed a few engines, and then proceeded to develop this engine along lines best suited to their own constructional practices and in conformance with their own ideas on what constitutes a practical marine Diesel-engine for merchant service. Consequently, the design differs somewhat from the engine built by the Licensors.

They have several large sea-going motorships to their credit, including the "Arum," "Arabis" and "Toiler," the first two being of 1,200 shaft H.P. and have seen over four years' service, while the last was an under-powered vessel placed in service on the Great Lakes about 1911. During the war they were not permitted to build motorships for merchant work, but now the urgency of war-production has passed, they have renewed their efforts in marine Diesel-engine construction and have recently completed designs of a new model. Owing to great pressure on space we were unable to publish the same in an earlier issue, as indicated in our last issue, so the design already has been published in England. Thus in this case "Motorship" was unable to follow its usual policy of premier publication of such an important article.

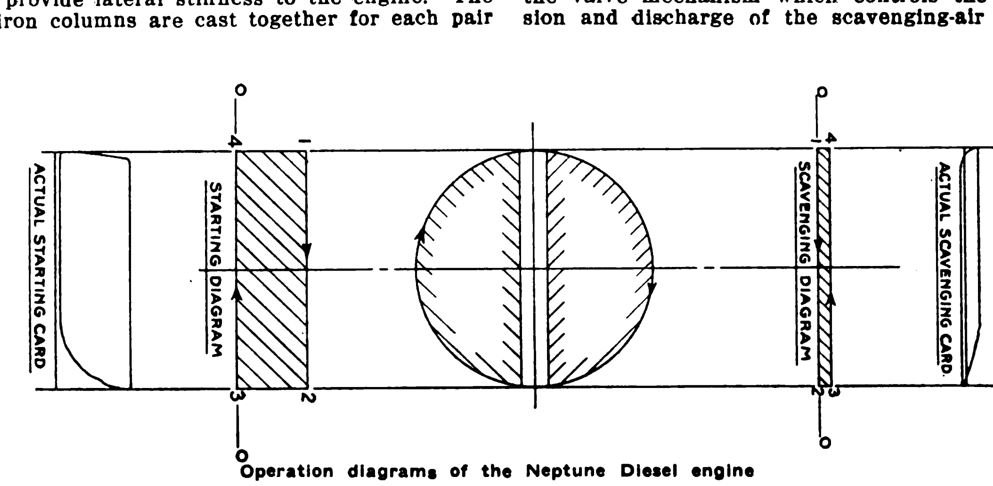
This new model is a development of the engine described and illustrated in the June, 1919, issue of "Motorship" and is of the two-cycle stepped-piston type and has an output of 1,500 I.H.P. at 115 R.P.M. from six cylinders 18 inches bore by 37 inches stroke, the stroke-bore ratio being a little over 2 to 1. But, this is not the only model they are developing, as they are producing a design for installation in hulls where moderate height is an important consideration, the difference being that the scavenging-pistons are driven by rocking-levers operated off the cross-heads, instead of being arranged below the working-cylinders in the form of stepped-pistons, thus saving quite a little in height.

In the design of the stepped-piston model every effort has been made to secure the greatest reliability and durability of all parts of the engine. It is of the direct-reversible, single-acting class, entirely self-contained, the air-compressor, cooling-water pumps and bilge-pumps all being run directly off the main engine.

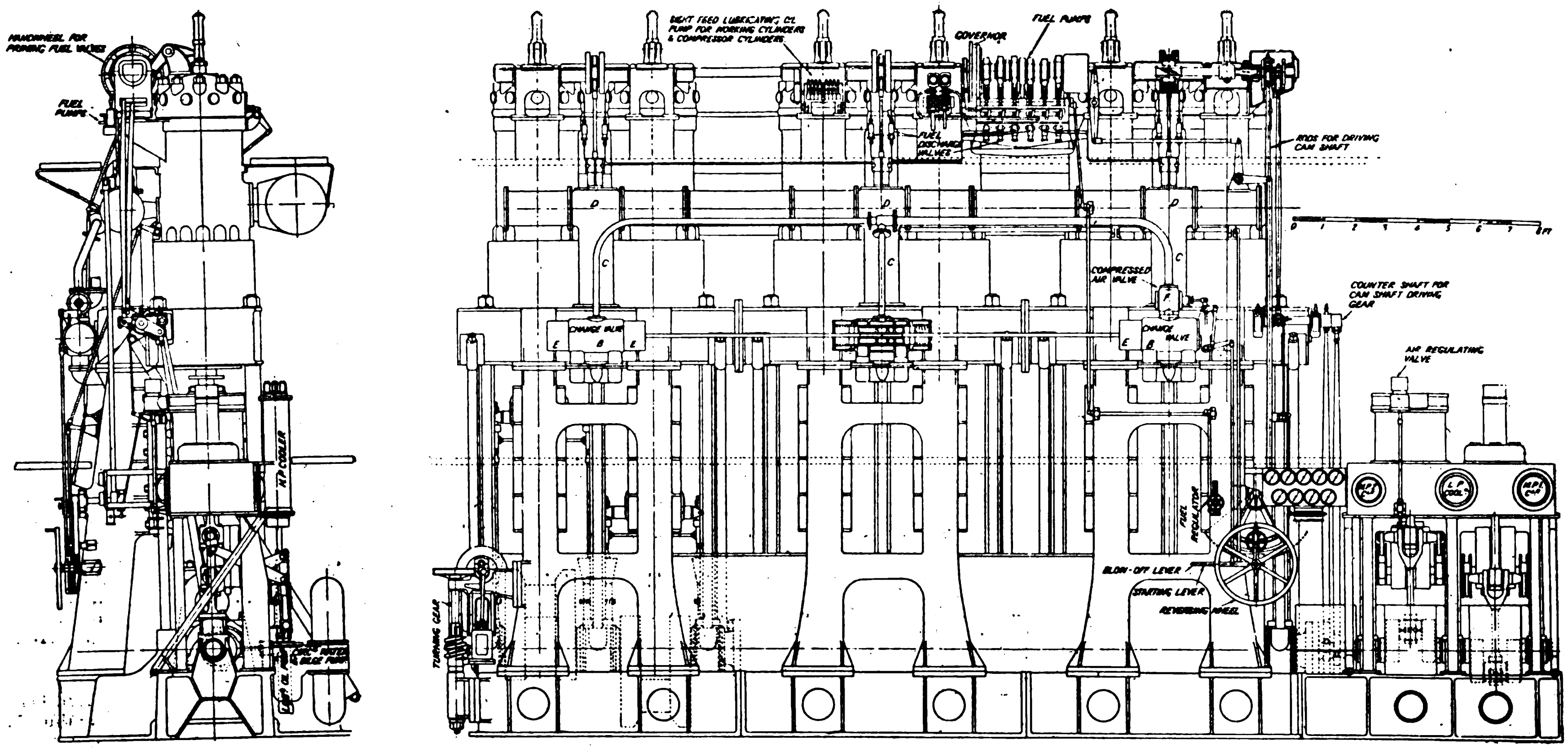
Its general design is shown by the reproduced drawings. The working-cylinders have each a scavenging-pump arranged directly below, which are supported by cast-iron columns, arranged at the front of the engine and by vertical steel columns at the back. Continuous bolts connect the scavenging-cylinders and bed-plate, and diagonal rods provide lateral stiffness to the engine. The cast-iron columns are cast together for each pair of cylinders and are arranged to carry the cross-head guide plates. Each pair of scavenging-cylinders are also cast together, and the bed-plate is made in sections for each pair of cylinders. Following the present practice of many American and European builders the crank-shaft is of the built-up pattern in sections of two cranks, two cylinders thus forming one unit, allowing the engine to be built with two, four, six, eight or more cylinders.

Every working-cylinder is fitted with separate liners, easily removed by means of a special gear supplied for starting the liner, when the ordinary lifting gear can be brought into operation. This arrangement of liner has been well tested and has proved very satisfactory. It is essential from time to time to be able to remove the scale from the water jacket and especially from the outside of the liner, and this can very readily be accomplished.

A special feature of the Neptune engine is that the valve mechanism which controls the admission and discharge of the scavenging-air to the



Operation diagrams of the Neptune Diesel engine



General arrangement of the 1,500 shaft H.P. Neptune marine oil-engine

scavenging-cylinders, is also adapted to control the admission and discharge of the compressed-air for starting the engine, an arrangement which greatly simplifies the starting mechanism and which has proved very successful in previous Neptune engines. The arrangement of the valve-gear is clearly indicated on the drawings. The main parts of each set of the valve-gear consists of a piston-valve A which controls the direct passage of the scavenging-air or of the compressed-air for starting, as the case may be, to and from the scavenging-cylinders through ports in the scavenging-cylinders walls, and a change-valve B which serves to admit either the scavenging-air or the compressed-air for starting to the piston-valve (A) as may be desired. The piston-valve (A) is actuated by an eccentric on the cam-shaft, the eccentric being set by an axial movement of the cam shaft to the required position for driving the engine in the desired direction.

Changing of the cams on the cam-shaft and the setting of the eccentric for the valve-gear are thus effected in a single operation by imparting an axial movement to the cam-shaft. One set of valve-gear is provided for each pair of cylinder units, the cranks of each unit being arranged 180 degrees apart for this reason: above the piston-valve (A) is arranged an air receiver, consisting of a vertical pipe (C) and a horizontal pipe (D) from which the scavenging air passes to the working cylinders.

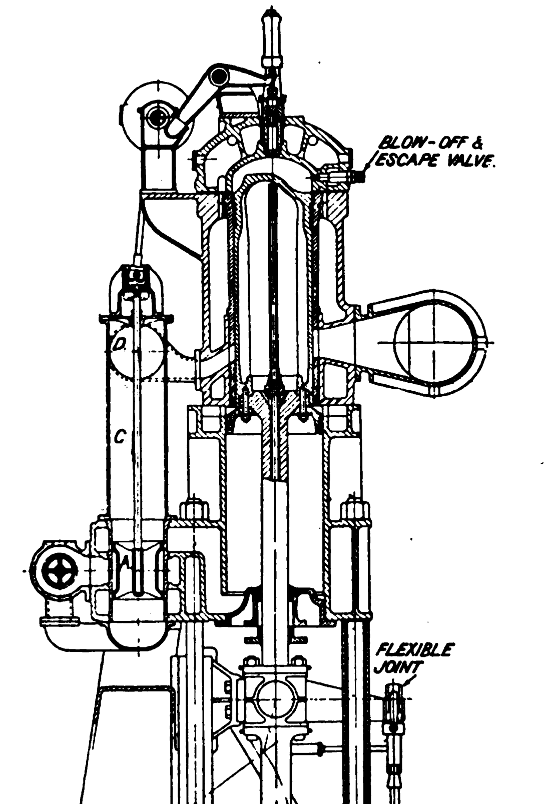
Atmospheric air for scavenging purposes is admitted to the change-valve (B) through the inlet ports (E and E) while compressed-air for starting is admitted through the compressed-air valve (F). The change valves B are placed in the desired position by means of a lever worked from the starting platform. In order to diminish back-pressure or exhaust resistance when starting with compressed-air, the change-valve B is arranged so that most of the air is exhausted through the ordinary air-intake pipes E and E.

When the piston-valve A is below the central piston, air passes through the bottom row of ports into No. 1 scavenging cylinder, and at the same time the top row of ports are open and allow No. 2 scavenging cylinder to discharge into the receiver C. When the piston-valve A is above the central position No. 2 scavenging-cylinder is taking in air through the top ports and No. 1 scavenging-cylinder is discharging into the receiver (C) through the bottom ports.

The working of the piston-valve A may be readily followed from the theoretical valve diagrams given. When the crank of the engine is just over the bottom centre between the points 4 and 1 both the admission and exhaust ports are closed. The admission-port is opened at 1 and closed at 2 and the exhaust-port opened at 3 and closed at 4. The corresponding theoretical tions are shown on the sides of the valve diacal diagrams for scavenging and starting operations are shown on the sides of the valve diagram, that on the right-hand side being the scavenging diagram and that on the left the starting diagram. The line O-O in each diagram indicates the atmospheric pressure.

Actual starting and scavenging diagrams taken from an engine of this type are also shown.

The cam-shaft driving gear is also very interesting, this being effected by means of eccentrics, rods and counter shaft. This type of gear is readily adjustable and has been well tested on previous Neptune engines with highly successful results.



Section of the Neptune 1,500 shaft H.P. Diesel engine

For the injection of fuel each cylinder is provided on the top with a fuel-injection valve, each of which is supplied with fuel by a separate fuel-pump, which is arranged with double discharge-valves to prevent leakage. The fuel-pumps are also arranged so that during the time the engine is being reversed, they are out of action, thus eliminating any possibility of excessive pressure in the cylinder during this time. Control of the suction-valves of the fuel-pumps is by a centrifugal governor driven by the cam-shaft.

There are four cams in all for each cylinder, two for full power, one ahead and one astern, and two half cams, one ahead and one astern, the latter being arranged for slow running and for economizing the injection-air.

As the starting and scavenging air is led through ports, the fuel-injection valve and the escape-valve are the only valves placed on the top of the cylinders, and the number of small working parts is therefore much reduced in comparison with those Diesel engines which have valves on the cylinder top for the operations referred to. This the Neptune designers consider a material advantage.

For cooling the pistons the water service has been specially considered in the design. Sea-water is used for this purpose, entering and leaving the piston through telescopic-tubes by way of the hollow piston-rod, large air-vessels being provided to prevent water hammer. The arrangement of the telescopic-tubes can be seen on fig. 2, and it is interesting to note that a flexible connection is provided for the attachment of the top of the tube to the brackets on the crossheads, thus any movement of the crossheads will not affect the alignment of the telescopic-tubes.

The air-compressor is single-acting, and for large engines would be of the four-stage type, while for small engines the three-stage type would be adopted. The compressor is arranged to be driven from the crank-shaft at the forward end of the engine. The intercoolers, which are of the tube type, are self-contained with the compressor, and are easily accessible. Each cooler is fitted with a separator and thermometer pockets. The T.P. cylinder is fitted with a loose liner, while the other cylinder liners are cast with their water jackets. The castings are quite separate from the main framing and are easily renewed.

Circulating-water pumps and the bilge pumps are placed at the back of the compressor and are driven by levers. There is one pump for the cooling water to the working cylinders and the compression, and one pump for the cooling-water to the pistons, and are so arranged that with a twin-screw installation one pump can supply the whole of either engine with cooling-water while the other is being overhauled. It is interesting to note that the bilge-pumps are duplicates of the circulating-water pumps and all pumps are fitted with efficient air-vessels, both on the suction and discharge.

Conversion of Another Iron Sailing-Ship

Trials of the "Katherine." Now a Bald-Headed Motor Schooner

MUCH interest has been evinced in the trials of the M.S. "Katherine," the latest addition to the fleet of motor tankers owned by the Philippine Vegetable Oil Company, which has just made her maiden voyage from San Francisco to Manila, P. I., in 35 days—a distance of 6,800 nautical miles at an average speed of 8 knots.

This vessel, which was formerly a four-masted, square-rigged, British-built, iron sailing-ship, is of the following dimensions:

Length overall	286 ft. 9 in.
Length between perpendiculars	275 ft.
Breadth moulded	43 ft. 5 in.
Depth moulded	24 ft. 1 in.
Gross register	2,196 tons
Net register	2,087 tons
Under deck	2,056 tons
Power	640 b.h.p.

and has been converted into a six-masted bald-headed schooner for the purpose of taking advantage of favorable winds which might occur, although it is intended that the engines shall be the main source of power and run continuously. She is equipped with twin 320 b.h.p. Bolinder oil-engines of the latest type with air-injection of fuel as motive power, but we consider that she should have had twin 500 b.h.p. engines.

tion of lubricant, and in connection with this there is an arrangement for saving and filtering all waste oil.

Ample room and an orderly layout has been obtained in the engine-room not only for the main engines, but also the auxiliaries with which this vessel is well equipped. The engines are firmly secured on well designed and substantial foundations, which adds considerably to the success of any marine plant.

One 25 b.h.p. stationary Bolinder engine, running at 375 revolutions per minute is direct connected to a 15 k.w. generator and also by clutch coupling on the opposite end of the shaft to a two-stage air-compressor. This latter is a duplicate of the one on the main engine and is used for providing starting-air, or injection-air, for the main engine in case of an accident to the main engine air-compressor. Additional power for the auxiliary machinery is provided by a 15 b.h.p. Bolinder engine turning 450 revolutions per minute, direct connected to a 10 k.w. generator and one 8 b.h.p. Bolinder engine running at 550 revolutions per minute, direct-connected to 5 k.w. generator. All generating units deliver 110-125 volts.

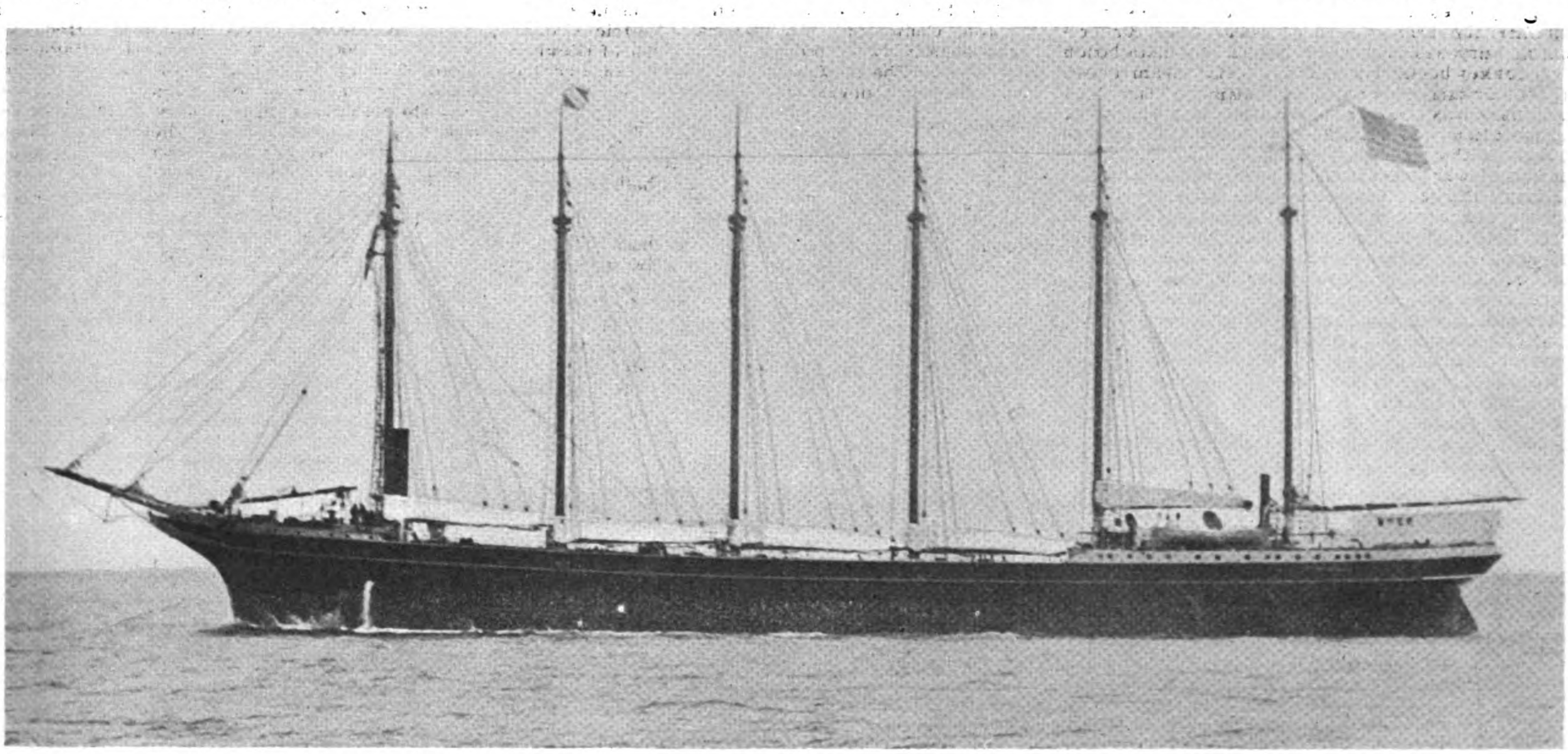
The main bilge and engine circulating-water pumps are driven from the forward end of the

type with all accessories for handling this class of cargo. The vessel is also fitted with a wireless equipment, having a range of over 3,000 miles.

Accommodations are provided for the captain and officers in the aft end of the ship, and are equipped in the most comfortable and up-to-date fashion, besides staterooms and offices for the owners and their guests.

The M.S. "Katherine" left Hanlon's Dry Dock & Shipbuilding Co.'s plant in Oakland on August 29th at 11 A. M. and proceeded up San Francisco Bay to the measured mile course where several runs were made. Observations were taken by officers of the Philippine Vegetable Oil Company, Lloyds representative, the naval architect, Mr. David Dickie, and the officials of Hanlon's Dry Dock & Shipbuilding Co. The agreed results showed a speed of 7.02 knots against the tide and 9.02 knots with the tide, or an average of slightly over 8 knots. During the trial the ship was fully loaded, the cargo tanks having been filled, the draft forward being 20 ft. 2 in. and 20 ft. aft.

Such satisfactory results as were obtained on the trial demonstrate the wisdom of the owners in making a careful selection of a good hull and in carefully designing and carrying out the work in a most efficient and substantial manner. Everything



M. A. "Katherine" converted from a four-masted square-rigged ship. Built in 1897 by Barclay Curle & Co., Ltd., Glasgow. She is now owned and operated by the Philippine Vegetable Oil Co. Recently fitted with twin 320 H.P. Bolinder heavy oil-engines

In fitting the vessel for the trade in which she is to be engaged for the future, namely, the carrying of vegetable oils in bulk, the hull has been divided into ten tanks, having a total cargo capacity of 3,000 tons on a 22 ft. draft.

Every facility has been provided for the rapid handling of this type of cargo. An elaborate and most efficient system has been devised for heating the oil to facilitate the rapid discharge of the cargo, which is done by means of powerful pumps, it being possible to discharge the total cargo in less than ten hours. The machinery installed for the purpose of taking care of the handling of the cargo which is done by means of powerful pumps approximately 900 square feet of heating surface, having a working pressure of 150 pounds and equipped to burn fuel oil.

Besides the main pumping system, there is a secondary or drainage system for taking care of the oil below the large main suctions. The pumping room is situated in the forward part of the ship between bulkhead 110 and 126.

The cargo pumping machinery consists of two duplex steam pumps, 16x19½x12, handle the main cargo, and these are supplemented by one auxiliary cargo pump, 6x4x4, one fire pump, 10x6x10, and one feed pump, 6x4x6 for boiler service, etc. The oiling system as developed for the main engines results in a considerable reduction in the consump-

crankshaft of each engine. The auxiliary pumping machinery consists of one 4 in. by 6 in. triplex electrically driven fire pump with connection to sea and bilge; one electrically-driven 6½ in. by 8 in. triplex pump for fire and bilge and emptying and filling coffer-dams, direct-connected to a 20 h.p. motor, and one 3 in by 4 in. electrically-driven sanitary pump direct-connected to 3 h.p. motor.

Fuel oil is carried on the double-bottom tanks under pump rooms and in the fuel-oil tank aft of the engine-room; the total capacity being 2,200 barrels, sufficient for 100 days' running. Two cylindrical day tanks, having a capacity of 26 barrels, are placed in the forward part of the engine-room. Storage for 3,000 gallons of lubricating-oil is provided for in two circular tanks with connections via filters to lubricating-oil day service tanks.

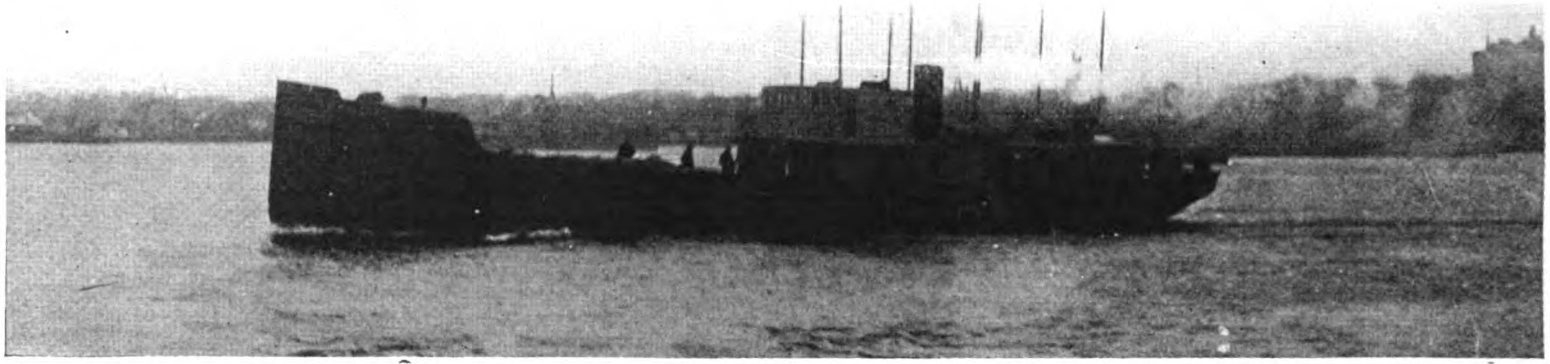
Besides the machinery already mentioned, the 'Katherine" is equipped with a most complete refrigerating plant, consisting of one motor-driven Jarvis ice-machine with a capacity of 1¼ tons per day and nearly 1,000 feet of refrigerating space for ship's stores. Steering is accomplished by means of an electric steering gear, fitted by the Herzog Electric Company of San Francisco.

In addition to the oil-cargo space provided for in the tanks, the vessel has 20,000 cubic feet of dry cargo space, and to handle this cargo four winches have been provided of the most modern

has been done to make this vessel the very finest of its type.

The engines ran smoothly and without vibration. Officers of the company, and the officials and visitors who were on board, expressed their satisfaction with the results of the test. Upon the completion of the trials, the ship proceeded to Martinez to take on a cargo of case-oil for Manila, where she will engage in her regular trade of carrying vegetable oils. The engines were supplied by Messrs. Henry Lund & Co. of San Francisco, the Pacific coast agents for the builders of the engines. The work of converting the ship was carried out by Hanlon's Dry Dock & Shipbuilding Co. of Oakland to the plans of naval architects Messrs. D. W. and R. Z. Dickie, of San Francisco. Direction and supervision of the work was handled in the Philippines Vegetable Oil Co.'s San Francisco office.

It may be added that on account of the showing made by the "Katherine" on her trial trip, and the substantial way in which the work has been carried out, the vessel has received the highest classification from Lloyds. Similar service is being performed by other tankers equipped with heavy-oil engines, one the M.S. "Nuianu," powered with one 320 b.h.p. Bolinder, and another, the "Tankerville," equipped with twin 500 b.h.p. engines.



The new Diesel electric-driven trawler "Mariner" running trials at New London. She is owned by Mr. F. W. Davis of Gloucester

Diesel-Electric Drive For Trawlers

Successful Trials of New Five-Hundred Ton Fishing-Vessel With Heavy-Oil Engine and Electric Transmission For Propelling and Auxiliary Power

Hitherto the owners of trawlers have not been very friendly disposed towards the heavy-oil engine for power in this class of fishing-vessel because it is not flexible enough at slow-speeds and consequently does not show its good qualities when handling the trawl-winch, so when used for propelling purposes it usually meant the installation of a donkey-boiler for operating the steam trawl. In Gt. Britain hydraulic transmission for deck machinery was tried on some small craft, and while its operation was satisfactory it did not seem to appeal to the average fisherman, also the intervention of war prevented further developments.

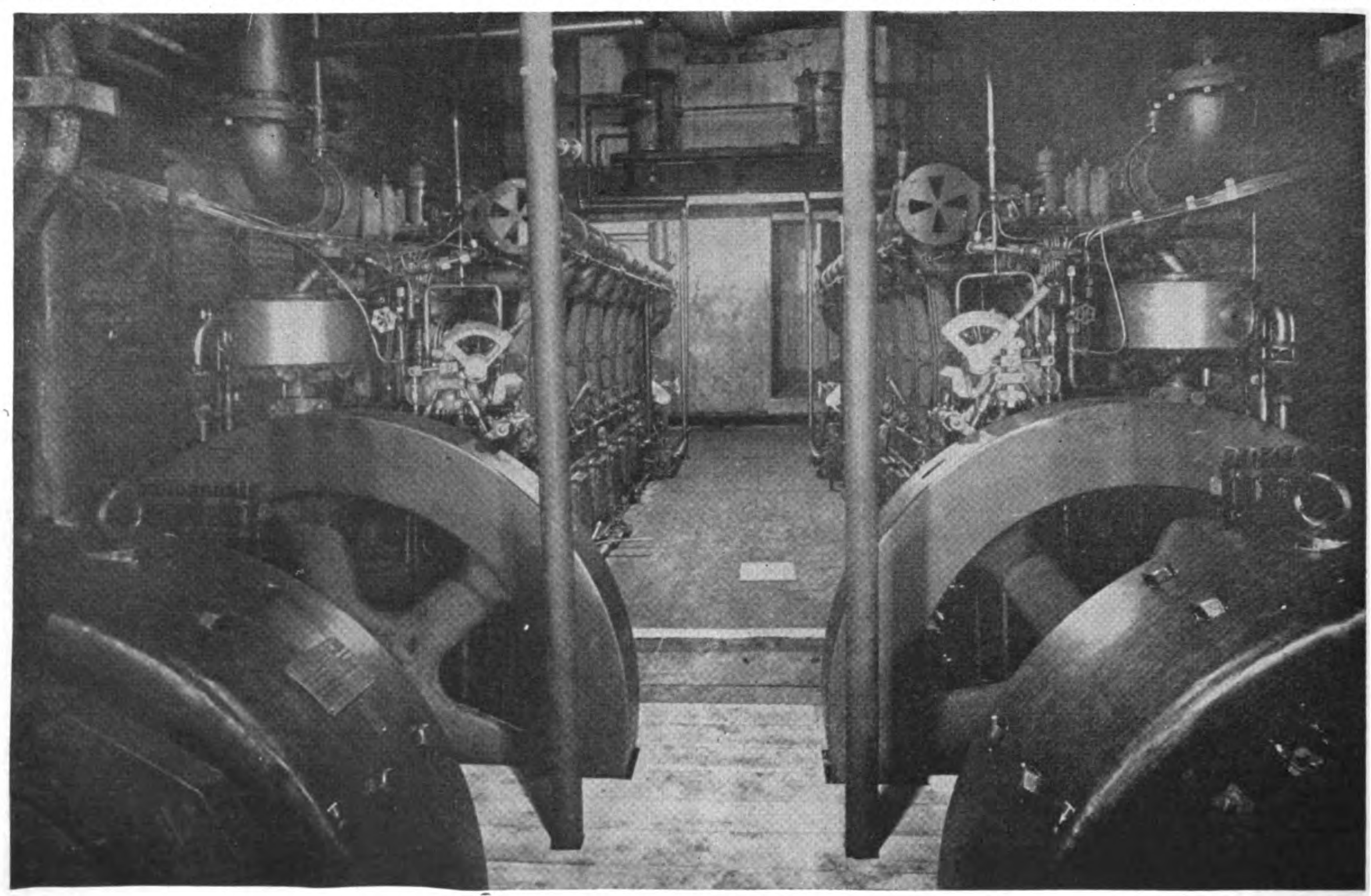
During the last few years the rapid growth of the merchant motorship has been the cause of perfection of electrical appliances for engine-room and deck auxiliaries and these now have been developed for trawlers and other fishing craft, so there is no longer any reason to be dubious of heavy-oil engine machinery in this class of vessel, of which several now are in service on the Atlantic coast of America, as well as a number in Europe.

However, the new trawler "Mariner" which has just run successful trials on the Massachusetts coast, is of unusual interest, as, not only is she Diesel oil-engine powered, but her propeller-shaft is not direct-coupled to the engines, electric transmission being installed, and all her auxiliary equipment is electrically driven. This interesting vessel has been built by Mr. Arthur D. Story of Essex, Mass., and her machinery was designed and installed by the New London Ship & Engine Co., of Groton, Conn., and the General Electric Co., of Schenectady, N. Y., for Mr. F. L. Davis, of Gloucester, Mass. She is of wooden construction and has the following dimensions:

Displacement	500 tons
Length	24 ft. 3 in.
Mean Draught	11 ft. 9 in.
Power of Diesel Engine	480 Shaft H.P.
Number of Engines	2
Number of Propellers	1
Power of Electric Motors	400 Shaft H.P.
Output of Electric Generators	165 Kw. at 125 volts
Power of Trawl Motor	100 B.H.P.
Engine Speed	350 R.P.M.
Propeller Speed	200 R.P.M.
Propeller Dimensions	94-in. dia. by 68-in. pitch
Ships Trial Speed (at 195 R.P.M.)	10 knots
Cruising Radius at 10 knots	6,000 nautical miles
Cruising Radius at ¾ speed	9,000 nautical miles
Fuel Tank Capacity	17,000 gal. (425 lbs.)

The propelling machinery consists of twin eight-cylinder, four-cycle, Nelseco Diesel-engines, each rated at 240 B. H. P. at 350 R. P. M. These engines are direct-connected to two 165 K. W. 125 volt generators. For propulsion purposes, these two generators are run in series and supply power to the main electric motor, which is rated at 400 B. H. P. at 200 R. P. M. The rated voltage on the motor is thus 250 volts. If so desired, the main motor can be run at any reduced voltage and in case the maximum impressed voltage on the motor does not exceed 125 volts, then one of the generator units can be shut down entirely and the motor operated entirely from the other generator unit. Connections are supplied and means of adjustment are provided so that any range of voltage and current can be supplied to the main motor and the load divided up on the main generating-units as desired.

Another important point in connection with this installation is that a large motor, that is to say about 100 H.P., is required for the winch for handling the trawl. This motor is a 125-volt machine and takes its power from either one of the main generating units. Furthermore, all the other auxiliary power and lighting circuits on the boat are of 125 volts, so that power for either the lights or the auxiliary machinery can be taken from either



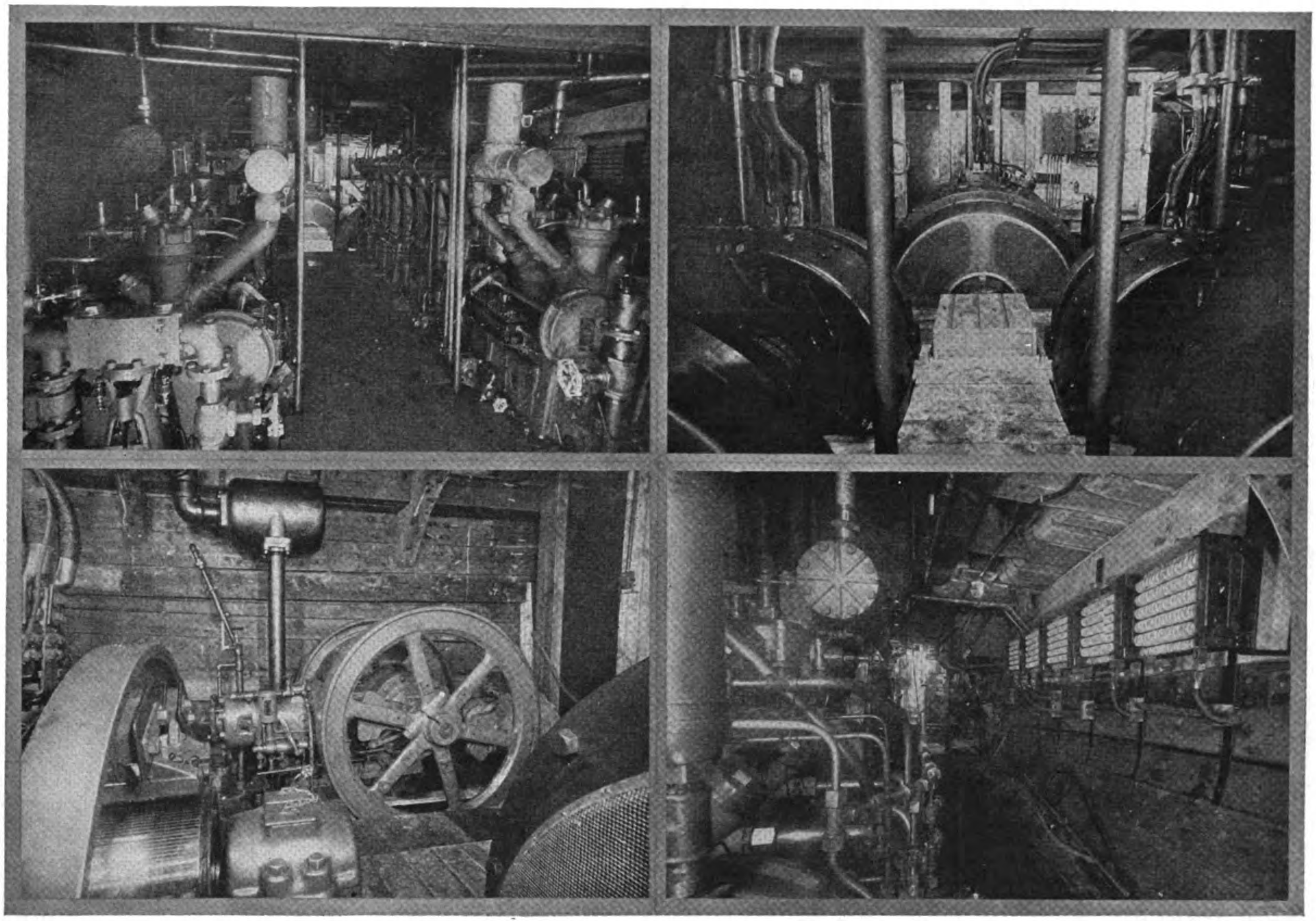
Engine-room of the "Mariner" looking aft from between the two main generating-sets

one of the main generating units even though these main generating-units may be supplying power to the propelling motor. Furthermore, there is a small auxiliary generating-set, consisting of a 15 H. P. Fairbanks Morse heavy-oil engine driving a 10 K. W. 125-volt generator by means of a silent chain. This auxiliary unit will be required only when in port and both of the main generating units are shut down. At sea, the two main generating-units will be running most of the time and in any case, one will have to be running and at that time all the power required for both lights and auxiliary power can be taken from either one of the units. It will be readily seen that this is a very flexible arrangement and not only provides great security against total failure but also requires a minimum amount of machinery to be in operation at any time. It also means what machinery is in operation will be loaded up to good advantage and thus obtain good fuel economy. There is a small motor-driven emergency air compressor which can be used in cases of emergency to fill the air starting bottles. While with the two engines available for generating power, there is very little likelihood of a total loss of starting-air or even a lack of fuel-injection air due to the breaking down of the regular compressor equipment, at the same time, if by any chance, all starting-air is lost, the auxiliary generating unit can be started by hand. It will supply power for the emergency compressor set and thus obtain starting-air enough to start one generating unit and then the other. The air-compressors on the main generators are of very large capacity so that even though both compressors on one engine failed, there would still be enough fuel-injection air available from the other unit to keep both units going at slightly reduced power. With all these arrangements, it is almost impossible to conceive a situation where all power will be lost and the ship unable to make its own way to port. Of course, there is only one propelling motor and one propeller; but, since the electric-motor is of such very heavy-duty type, there seems to be little likelihood of anything of this kind happening, and certainly the ship is far better off in this respect than even a single-screw steam reciprocating-engined vessel.

The arrangement of machinery shows the main electric-motor placed at the forward end of the engine-room with the line shafting running down between the generator units. The main generator units are placed with the generators forward adjacent to the main motor and the switchboard is placed on the starboard side of the vessel at the forward end of the engine-room so that all electrical leads to and from the motor and generators are as short and direct as possible. There are several reasons for placing the motor at the forward end of the engine-room. In the first place, the lines of the hull are so fine aft that it would be impossible to locate the motor and generator units to advantage in any other way. Secondly, the thrust-bearing is placed adjacent to the main motor and with this arrangement it is only necessary to lift a section of line shafting in order to be able to draw the tail-shaft into the boat and remove it. Trawler owners will readily appreciate this point. Another reason for locating the electrical machinery at the forward end of the engine-room is that it places it higher above the lowest point of the bilge so that any bilge-water, etc., will readily drain away from the machinery. This arrangement of machinery gives ample room around every part and the advantage of this when it comes to care of the machinery during operation and when overhauling is readily appreciated by all members of the engine-room force. The engineer's quarters are located right aft of the engine-room beneath the after deck house. The captain's cabin is on top of the after deck house abaft the wheel house, while the crew are forward in the forecastle below the main deck. The galley is in the after deck-house.

The official trial of the "Mariner" was held on Saturday, November 29, 1919. Dock trials had been held previously but this was the first real test at sea and the ship lived up to expectations in every way. The first test was more of an endurance trial, during which the engines were operated at increasing power, finally working up to full power and speed which was maintained for several hours. The speed of the boat was a little over ten knots and was obtained at about 195 turns of the three-bladed cast-iron propeller. The "Mariner" ran very steadily and the general absence of vibration was very noticeable. In fact, at any part of the ship except in the immediate vicinity of the engine-room, there was nothing to indicate the presence of any power in the vessel. Fuel-consumption at full power amounted to about 30 gallons per hour, which on the basis of the fuel-tank capacity of 17,000 gallons gives a radius of action of about 6,000 sea-miles. At the conclusion of the full-power test, various maneuvering trials were held and the capabilities of the arrangement in this line were amply demonstrated. With one engine shut down entirely and conditions adjusted to load the other engine up to full power, a little over three-quarters speed was attained. The economy of such an arrangement is at once apparent, since the fuel-consumption was cut-in-half and the speed was reduced only about 25 per cent, thus giving a radius at this speed of nearly 9,000 nautical-miles, which is something of an achievement for a boat only 140 feet long with only 61 tons of fuel aboard. Quick reversing trials were also held. In connection with this, it should be noted that the control of the motor is carried right up to the pilot-house and there all movements of the main-motor are controlled by a controller which looks very much like the ordinary trolley-car controller. There is a small lever which determines ahead, stop, or astern rotation and also the regular controller handle which determines the revolution speed. Electrical instruments are fitted adjacent to this controller in the pilot house showing the conditions at all times so that the captain can see at a glance just what generator units are running, how much load they are carrying and just what the main propelling motor is doing. It was found on the average of several trials that starting with the ship going full-speed ahead, it took on an average of two seconds from the time when the signal was given to the time when the propeller started in the reverse direction. Furthermore, it took from 15 to 18 seconds, starting with the ship going full-speed ahead, from the time when the signal was given to the time when the propeller had been reversed and the main motor was developing full power and speed astern. An important point in connection with this control-gear in the pilot-house is the automatic resetting of the circuit breakers in case it is accidentally tripped by supplying power to the motor too fast, by simply bringing the controller back to the stop position. In this way no time is lost and it is not necessary to wait for somebody in the engine-room to reset the circuit breakers. The advantage of this when maneuvering in close quarters is readily appreciated.

It was also interesting to be down in the engine-room during these quick reversing trials. The main generating units run on the governors at all times and the engineers have only to give the engines the usual attention while running. They do not know, unless they happen to look at the switchboard,



TOP LEFT: Forward end of the "Mariner's" engine-room showing main electric-motor in center and two Diesel-engines in foreground. TOP RIGHT: The two electric generating units and the main electric-motor. LOWER LEFT: Forward port corner of engine-room showing auxiliary generating unit. LOWER RIGHT: Starboard side of engine-room showing the main motor control repostate on the right.

and in a way do not care what load the engines are carrying, since this is taken care of by the control in the pilot house. The electrical apparatus, of course, gives no indication whatever in regard to changes in load or reversal of speed in connection with the main motor and the only indications that the engines give that the load has been suddenly thrown on or off in maneuvering is the slight change in sound of the engines due to the slight change of speed. In fact, to the ordinary observer in the engine-room, unless he happened to be watching the electrical instruments on the switchboard, he would never know that the boat was being maneuvered or, in fact, whether or not the main motor was running.

At the conclusion of her trials, the "Mariner" returned to her dock in New London and after some minor fitting out, she left for Gloucester on December 3d, where she will have the winch and other gear for handling the trawls installed.

It should also be stated that there is a controller in the engine room for handling the main motor, similar to the one in the pilot house, so that if desired the captain can give the usual gong signals to the engine-room and the engineers control the main motor with the controller there. The change from engine room to pilot-house control is accomplished by simply throwing a switch on the engine-room switchboard.

Several changes are to be made to the outward appearance of the vessel, the illustration showing her in an uncompleted state. She is to have two masts, and these together with the completion of the house around her trawling-winch and the fitting of other deck gear will make quite a little difference.

As regards the Nelseco Diesel engines, these are of the same design as were described and illustrated in our issue of April, 1919, and pressure on space prevents redescribing them here. But each of the eight cylinder sets has a bore of 9 ins. by 12½ ins. stroke and operates on the four-cycle single-acting principle. Its length is 15 ft. 1 in. overall by 3 ft. wide and the engine stands 5 ft. 6 in. high from the shaft center. Its weight is 13½ long tons.

We suggest that merchant ship owners, as well as fishing-vessel owners, closely watch the operation of this ship in service, as she will give a good indication as to the possibilities of the use of Diesel-electric drive on much larger ships.

BRITISH MARINE ENGINE EXHIBITION

The British motorboat and marine internal-combustion engine exhibition will be held at Olympia in March 1920 under the jurisdiction of the British Gas & Oil Engine Manufacturers Association, the Ship and Boat Builders Association, and the Society of Motor Manufacturers and Traders. American firms desirous of exhibiting should send their applications at an early date.

VICKER'S-ENGINED AUXILIARIES FOR ANGLO-SAXON PETROLEUM CO.

Eight converted sailing vessels belonging to the Anglo-Saxon Petroleum Company of London have been fitted with Vickers solid-injection high compression oil-engines. On tests Vickers engines have registered a consumption as low as 0.376 lb.

AMERICANS PURCHASE AUSTRALIAN MOTORSHIPS

It is reported that nine full-powered Diesel-driven wooden motorships built at Seattle and Olympia, Washington, for the Australian Government have been sold for $3,500,000 to the Seattle Bank, and will be placed under the American flag.

Mr. J. E. Chilberg is president of the Bank of Seattle. McIntosh & Seymour engines are installed in all these ships.

THE MOTORSHIP "PO" CONVERTED FROM SAIL

The 2,042 tons gross iron auxiliary-bark "PO" has been placed in service by Quaglia & Galdini, of Genoa. In this vessel twin four-cylinder 12 3-16 in. by 8⅛ in. Sulzer two-cycle type Diesel oil-engines have been installed. This vessel was built in 1899, at Liverpool, under the name of "Hutton Hall." She has just been classed 100 A-1 at Lloyds.

ANOTHER DIESEL TANKER ORDERED FROM VICKERS

We understand that the Anglo-American Petroleum Company have placed an order with Vickers, Ltd., of Barrow-in-Furness for a second Diesel-driven motor tanker. The first motorship ordered by this oil company from Vickers is the "Narragansett," now under construction.

FIAT 1300 B.H.P. MARINE DIESEL ENGINE FOR DISPOSAL

Among the marine-type Diesel engines offered for sale by the British Admiralty we note a six-cylinder 1300 b.h.p. at 360 R.P.M. two-cycle type Fiat motor.

THE TATE COASTWISE MOTORSHIP FLEET

Several 220 b.h.p. and 152 b.h.p. Vickers-Petters marine oil-engines have been ordered by Arthur Tate & Co., Ltd., exporters of coal and coke, Newcastle-on-Tyne, England. They already have in service the 360-ton cargo-vessel "Hibernia," which is fitted with a 152 b.h.p. Vickers-Petters surface-ignition type oil-engine, and have eleven other motorships in operation. Mr. Arthur Tate says that the "Hibernia" made nine and one-half knots light ship coming up from the Humber to the Tyne, and regularly does over eight knots loaded between Newcastle-on-Tyne and France. Her average passage with cargo from Tyne or Blyth to Calais has been about 38 hours, and the Captain boasts that he has beaten half of the steam-driven coasting vessels in the trade.

BURMEISTER & WAIN ENGINE TO BE BUILT IN GERMANY

An exclusive license to build the Burmeister & Wain merchant marine Diesel engine has been secured by the Deutsche Oelmaschinen G. m. b. H. This concern appears to be a branch or a reorganization of the company started by the A. E. G. and the Hamburg-America Steamship Co. to build Junkers-Diesel oil-engines during the war.

MORE CONCRETE MOTORSHIPS

Another 1,000 tons d.w.c. concrete motorship has been launched from the Fougner shipyard at Moss, Norway. This vessel has been named "Concrete," and is powered with twin 160 b.h.p. Bolinder oil engines. The total capacity of her holds is 50,800 cubic feet. This does not include the bunker. The new 700 tons d.w.c. concrete motorship "Linnen" also ran her trials recently. She was built at Malmo for the A. G. Betongett of the same city. Two oil-engines form her propelling power.

Franklin K. Lane Advocates Motorships

Deplores Waste of Oil Under Boilers

Secretary-of-the-Interior Franklin K. Lane, in his report for the fiscal year, advocates in connection with the Government's shipbuilding programme that internal-combustion engines be utilized, rather than that oil be burned under boilers to provide steam motive power. Mr. Lane says:

"Substitute the internal-combustion engine for the steam boiler and we multiply by three or three and one-half the supply of fuel oil in the United States.

"This Government might itself well undertake to develop an engine of this type for use on its ships, tractors and trucks. We simply can not afford to preach economy in oil when we do not promote by every means the use of the internal-combustion engine for its consumption. No other one thing that can be done by the Government, our industries, or the people will save as much oil from being wasted and thereby multiply the real production of the United States.

"If such engines are delicate of handling and need specially trained engineers, there should be little difficulty experienced in training men for such work. A nation that could educate 10,000 automobile mechanics in sixty days, might, indeed, develop 1,000 Diesel engineers in a year. The matter is of too great moment for delay. It touches the interest of everyone."

On November 18, Rear-Admiral Sir Philip Dunes, C. B., told the Institution of Petroleum Technologists that burning oil under ship's boilers is an abominable scandle, and he did not believe it was true that internal-combustion engines could not be got on a large scale.

FRANKLIN K. LANE
Secretary of the Interior

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THE FULTON DIESEL-ENGINED TUG "MANTEO"

It may be remembered that in May, 1918, a 100 h.p. Diesel-engine built by the Fulton Manufacturing Co. of Erie, was installed in the tug "Manteo" owned by the U. S. War Department. She made a trip from Lake Michigan to North Carolina where she has since been in operation as tender to a hydraulic pipe-line dredge, and has been used chiefly for towing pontoons, coal and water scows and running in the anchors also making trips to the nearest base for supplies and mail. According to the War Department the engine of this boat has rendered very satisfactory service.

We understand that the Fulton Manufacturing Co. are desirous of having this engine manufactured in quantities and would be glad to communicate with the firms interested.

THE MOTORSHIP "STUREHOLM"

Regarding the motorship "Stureholm," illustrated on page 30 of our November issue, her dimensions are as follows:

Dead-weight capacity	7,700 tons
Loaded speed	10¾ knots
Horse-power	2000 I.H.P.
Length overall	409 ft.
Moulded breadth	53 ft. 9 in.
Draught	26 ft.
Daily fuel consumption	9½ tons

Each engine has six cylinders, 23.288 in. bore by 35.433 in. stroke, and develops 1300 I.H.P. at 130 R.P.M. They are of the four-cycle Burmeister & Wain type, built by the Götaverken of Göteberg.

GLEN LINE'S NEW LARGE MOTORSHIPS

We have previously referred to the new motorships building for the Glen Line, and to the four 13,000 ton d.w.c. vessels, which form the largest of the fleet on order. "It is expected," says *Syren and Shipping*, of London, "that the first of the four largest craft will be ready early in the new year." They have the following dimensions:

Dead-weight capacity	13,000 tons
Power	6,400 I.H.P.
Power	5,400 B.H.P.
Fuel consumption	20 tons per day
No. of cylinders per engine	8
Bore and stroke	750m x 1,100m

These three vessels wil be very similar to the motorship "Glenapp," already in service of this company. When Messrs. Harland & Wolff have their new works at Glasgow in full operation they will be able to turn out annually a large horse-power of marine oil-engines. These works are housed in an impressive new building visible from the river and dominating the neighboring streets. Very little has been said about them as yet, but it is understood that when descriptions are available it will be seen they constitute one of the finest engineering establishments in the Glasgow area, and are quite capable of providing machinery for all the motorships which the firm may build—that will be no small task if present appearances go for anything.

Another Diesel-Electric Plan for Powering Wooden Vessels

Proposed Installation of Main Power Plant on Deck

In our November issue details were given of a scheme to economically power and operate the U. S. Shipping Board's surplus wooden hulls gotten out by the General Electric Company in conjunction with the Winton Engine Works. An alternative plan has been put forward by Mr. R. Z. Dickie in collaboration with the Westinghouse Electric Manufacturing, and the Winton Company.

In the Ferris type of hull there is between the top of keelson and the center of propeller-shaft a distance of only three feet and, in order properly to place the driving-motor and at the same time reduce its weight by adopting a higher speed, it is proposed to use reduction-gears. There are two motors on a common bed-plate with a common reduction-gear and an intermediate shaft interposed so as to facilitate removal of the tail shaft when necessary. This is a very flexible arrangement and has been suggested in place of a single heavy direct-connected motor.

Alternating current apparatus has generally been adopted for electrical marine propulsion, especially in high-powered vessels, and it has certain very decided advantages. The apparatus is more simple, higher voltage can be used and weights reduced, and first cost would be lower. On the other hand, control is much more difficult, and indeed quite impractical with a speed reduction of only three-to-one between the generators and the tail-shaft, and with both running at the relatively low speeds demanded in this particular problem.

Direct current, on the contrary, offers easy control and there are many advantages in its use for auxiliary machinery, and the Westinghouse experts propose its use with a complete electrical installation for all engine-room auxiliaries and deck machinery so controlled and wired that any-one of the three main driving-units may be used while in port to furnish all the power necessary for the operation of cargo-winches, anchor windlasses. For lighting, heating and any other necessary use while in port, auxiliary power is supplied by two 25 k.w. Diesel-engine driven generators.

In comparing this electric installation with propulsion by steam, it is assumed that three first-class electricians can properly care for the plant, and that their wages would just offset the wages of the firemen in the steam plant. The engines are placed on deck, supported by a heavy center-line and thwartship bulkhead just forward of the motor compartment, leaving almost the entire under-deck space for cargo. The fuel-tanks could be placed alongside of the keelson the entire length of the ship, giving a decided advantage in trimming when the ship is running light.

In order to illustrate the commercial gain of a Diesel-electric drive, placed in a wooden Ferris hull, a comparison will be given between two ships of this type, operating on the west coast, using available freight rates and charges, one vessel being equipped with a steam oil-burning plant with 1400 indicated H. P., and one equipped with an electric plant, giving the same effective H. P., at the propeller.

The Ferris ships have a length over all of 281 ft. 6 in., a B. P. length of 268 ft., a beam of 46 ft. and a depth of 26 ft. For comparison, we will take the Ferris ship with water-tube boilers and a triple-expansion engine with cylinders 19 in. x 32¼ in. x 54 in. and 42 in. stroke, operating at 90 R. P. M.

Former operators of these vessels say that they sailed with cargo varying from 2800 to 3000 tons as coal burners, but with oil being installed they should carry at least 3400 to 3600 D. W. T. tons, with the same cruising radius and have a sea-speed of ten knots, while as coal-burners they have averaged between eight and nine, as in many instances they were hard steamers.

Operators have gone through their books and made a statement of value per dead-weight ton for the last year, which is based on the total amount of freight carried, the amount received for this freight and the expense of operating a ship of this size as an oil-burner over a period of one year, and by the following data it will be seen that by installing the proposed electric-drive a saving of 80 tons in the original machinery weight would be affected, and 220 tons of oil would easily give the vessel the same cruising radius.

	Diesel-Electric Drive	Oil-Burning Triple-Expansion Plant
Indicated H.P.	1400 B.H.P.	1400 B.H.P.
Weight of plant installed	220 tons	300 tons
Fuel used per hour per Shaft H.P.	0.45 pounds	1.25 pounds
Fuel used per hour	1.9 barrels	5.4 barrels
Fuel used per day in barrels, at sea	42.7 barrels	129.6 barrels
Fuel used per day in port	8 barrels	26 barrels
Cost of fuel oil per barrel	$1.85	$1.60
Cost of fuel per day at sea	$87.32	$207.36
Cost of fuel per day in port	$14.80	$41.60
Days at sea	270	270
Days in port	95	95
Water used per day for Power Plant	00	3.75 tons
Fuel used per day—tons	6.74 tons	18.64 tons
Weight of fuel carried	220 tons	650 tons
Weight of fresh water carried	50 tons	170 tons
Cost of water per ton	$1.00	$1.00
Cargo carried in deadweight tons	3400 tons	3000 tons
Fuel used in year	13504 barrels	37462barrels
Water used in year for Power Plant	00	1125 tons
Total cost of fuel and water for one year	$24,983.00	$61,065.00
Profits of ship in one year	$170,000.00	$150,000.00
Total net profits per year	$145,017.00	$88,935.00

Over a period of a year in the operation of the vessel, taking the present cost of fuel and water, she would have an increased carrying capacity of 400 tons. and would net her owners about $56,082 additional, through the saving in fuel, water and weight, or a net gain in the commercial efficiency of the ship of about 38.6 per cent. (Our only comment is that the power should be increased to 1800—2000 I.H.P.—Editor.)

What Every Auxiliary Sailing-Ship Owner Should Know

Sidelights on Some Recent Installations

In this and all European countries the shortage of tonnage during the war and the opportunity for very lucrative freight-rates has induced owners of many old sailing-vessels in good condition to convert them into auxiliary schooners. Any kind of machinery whether suitable or not was installed with no regard for operating conditions.

The engine market during the last years has been much hampered in regard to providing quantity as well as quality in available engines. These owners have not had a great choice of machinery and have had to take anything they could lay their hands on. Surface-ignition oil engines large and small, of known and unknown makes, and Diesel engines of the most obsolete types can be found in many of these vessels both in this as well as in European countries. In most instances the ships are underpowered, as the propelling machinery was installed for the purpose of obtaining a speed of 5 to 6 knots! Only when favorable winds failed were the engines to be used but the skipper as well as the crew soon became aware of the advantageous and relative ease in operating a sailing-vessel with its auxiliary machinery and the engines became the main means of propulsion, while the sails were only used in favorable weather to increase the speed of the ship.

The writer knows of instances where the auxiliary propelling machinery was in operation for 50 to 60 days without interruption. Although supposedly fitted with engines as auxiliaries to her sails the latter were not used during the whole trip. Fortunately in this case the master contented himself with a speed of 5 or 6 knots and the engine stood the test. He recognized the fact that he could not expect a greater speed for a long period without overloading and damaging the engine. In most instances the engine crew have had a hard time persuading the master to keep a moderate speed. Most of these old sea-wolves have absolutely no idea what can be expected of an engine, and after realizing the benefits to be derived from them as auxiliaries promptly want to run them all the time. In many cases this has resulted in disaster, but the owners have placed the blame on the engines.

After the signing of the armistice the seamen's union in one European country obtained the passage of a law providing that all sailing-vessels engaged in overseas trade had to be equipped with auxiliary propelling machinery. As a result, every and any kind of an engine was immediately obtained and hastily installed in the ships of that country. Gasoline engines, surface-ignition motors and Diesel engines of all sizes, makes and mistakes, were used. As an instance—in America several vessels were fitted out with gasoline, or heavy oil engines of an obsolete, faulty design in order to comply with the law of their country and several of them never reached home. One caught fire and was abandoned as a total loss. She has just recently been destroyed as a derelict and menace to navigation.

The demand at that time was extensive but the owner of two certain schooners was able to obtain a pair of engines of proven reliability and well-known make with which to convert his vessels into auxiliary powered craft. On the test-block they gave satisfactory results and seemingly with proper care and without excessive overloading would produce dependable power after installation.

However, as has been demonstrated in many similar cases, without necessary care and an understanding of the requirements for installation, good results were not obtained. In the haste to save time a great error was made resulting not only in loss of time during the subsequent voyages but greatly endangering the ship itself besides the lives of the crew, the reputation of the engine builder, and the advance of the motorship.

No special care was taken in the arrangement and equipment in the engine-room. Anything seemed to be good enough. Sufficient space was not provided around the engine and overhauling or repairing was not even thought of, nor was any provision made for the easy handling of the heavy parts. No consideration was given the more important auxiliaries such as pumps, electric-lighting sets, etc.

A coal-fired donkey boiler was provided amidships in a deck house specially built for it, entirely separate from the engine-room, which was well aft. The engine-room skylight was not arranged with any decent regard for a bright, well-lighted engine-room and everything was about as unhandy and as poorly arranged as could be. Good storage and working quarters could have been provided in the space occupied by the bunkers. The lighting-set was installed in such an awkward position that the men preferred to use oil lamps at sea and even when in port, instead of going to the trouble to run the generator.

Carelessness in designing and laying out the engine-room was proven by the fact that after two or three days out on the first voyage the lubricating oil got mixed with sea-water, and a leak developed in the oil tank, so that none of it could be recovered and the whole supply was gone in a short time. This was not discovered until the engine gave signs of trouble. One cylinder became unusually hot in a very short time in the middle of the night in a heavy sea and dense smoke poured out of the crank chamber. The whole engine worked, pounding heavily until she could be stopped.

An inspection of the engine showed that the lubricating-oil circulation as well as the piston cooling was out of commission in two cylinders. The whole bilge was full of foam, a mixture of oil and sea-water and the oil circulating-pumps could not suck it. Fortunately the only damage done was the burning-out of two wrist-pin bearings and the cracking of several piston-heads, all of which could be either repaired or replaced with spares.

The crankshaft and its bearings did not suffer, but the trip across the Atlantic had to be completed under sail alone, taking 44 days. Thus twenty days were lost on the very first trip and this time was directly chargeable to the poor work done in installing the machinery in the hull.

There also was an absence of care in providing decent quarters for the ship's crew. The owner did not provide sanitary living conditions on this vessel. No running water, no apparatus to make drinking-water in case the supply should give, not even enough tank capacity for drinking-water storage was provided, and the latter actually did run out long before the destination was reached.

Interesting News and Notes from Everywhere

THE M.S. "SABARA" AGAIN CHANGES HANDS

The Sulzer engined motorship "Sabara," an illustration of which formed the frontispiece of our June issue, has been purchased by the French Government.

ZEPHYR COMPANY TO PURCHASE A MOTORSHIP

The Scandinavian shipbroker firm of Zephyr intends increasing its capital from Kr. 350,000 to Kr. 1,250,000 on account of the contemplated purchase of a Diesel-engined motorship.

ANOTHER ORIENTAL AUXILIARY

An 1,800 ton d.w.c. oil-engined auxiliary sailing vessel has been launched by Mr. A. C. Martin, of Rangoon. She is 230 ft. long by 38 ft. beam and 18½ ft. depth.

ARGENTINE MOTORSHIP

The first wooden motor auxiliary built by the Escandinavo-Argentine Shipyard has been sold for $350,000. She is a sailing vessel of about 900 tons d.w.c. and is fitted with heavy-oil engines for auxiliary power.

IN THE CAMP OF THE "RIVAL"

It is not known for certain, but we are rather suspicious that our "friendly enemies" are with us in spirit at least. There is a rumor about that a prominent geared-turbine manufacturer is about to develop a marine Diesel engine. Also, at least one of the firms that have been and are supplying *steam* machinery for the recent government shipbuilding program are simultaneously developing a Diesel engine for merchant ships.

MODERNIZING THE SAILING-VESSEL

To the lover of sea romance and history the day of the sailing-vessel wil never pass. We are, perhaps, too practical and unromantic, for it is with a sense of satisfaction and of seeing a good job well done when we learn of the increasing number of sailing-vessels being deprived of some of the lighter sails and fitted with auxiliary oil-engine power.

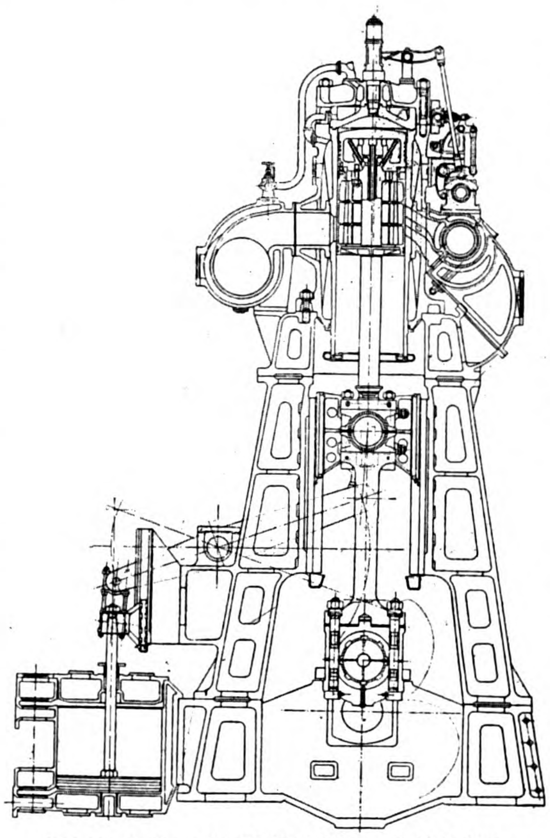
Two of the largest sailers in the Anglo-Saxon Petroleum Co.'s fleet, the "Horn Shell" and the "Medway," have been converted to auxiliaries. The former, a 2,200 ton vessel, was built at Belfast in 1892, the latter of 2,500 tons was produced at Dumbarton in 1902. Many other units of their sailing fleet have been converted to Diesel power and complete details will be given later.

PACIFIC COAST ENTERPRISE

A motorship passenger and freight-carrying line has been organized by Mr. Chas. A. Wiley and associates to run between Long Beach, Cal., and Mazatlan and other ports in Mexico.

BRAZILIAN MOTORSHIPS

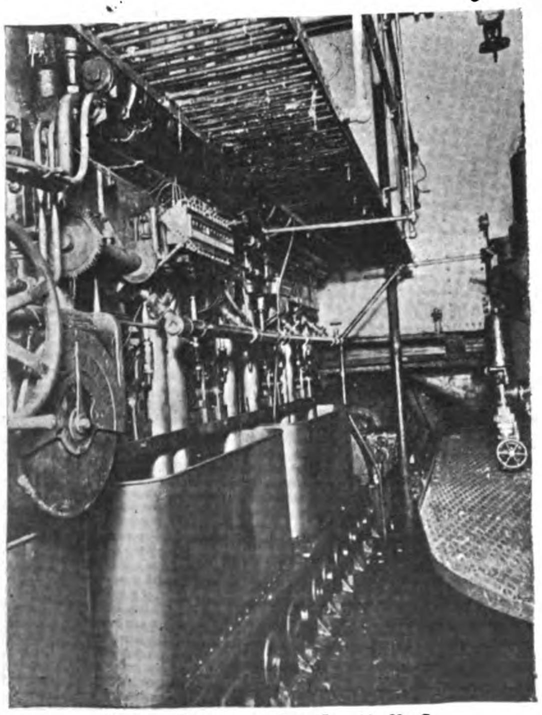
We have previously referred to the oil-engined wooden motorships building by the Lloyd Nacional of Brazil. Altogether there are six of these vessels launched or under construction.



Section of the new White 1,250 shaft H.P. two-cycle type Diesel-marine engine building by J. Samuel White & Co., Cowes, England. It is of the port-scavenging type

WOODEN SAILING-VESSELS CONVERTED TO MOTOR AUXILIARIES

Illustrated on this page are two views of an old sailing-vessel being fitted with internal-combustion engines. This alteration should result in a vessel capable of independent maneuvering and yet with very little loss in carrying capacity. We have been unable to inspect this work and thus are without any other comment concerning the suitability of the engine or engines for the work they will have to do. The engine illustrated appears to be a Southwalk-Harris Diesel. "Motorship" has often tried to stress the fact that a successful motorship calls for care in installation, selection of motor as to type and size, and very much upon the use or abuse of the machinery in service. We trust that the last of the mistakes in our wooden auxiliaries has been made. If shipowners now profit by past errors, the same will not have been in vain. In this connection we draw special attention to the article on page 35 of this issue.



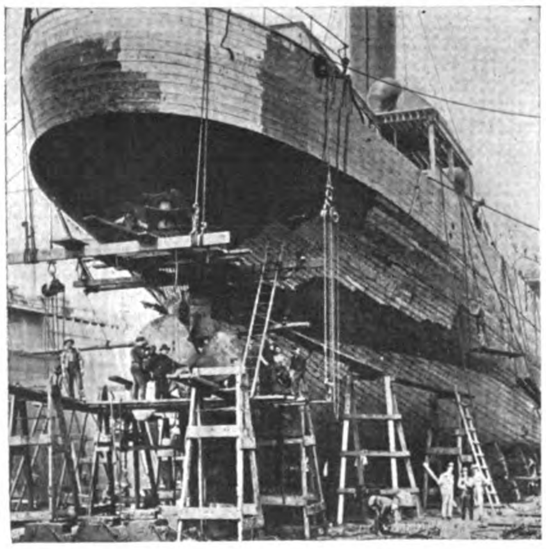


Photo. Keystone View Co., N. Y. C.

Old sailing-ships formerly relegated to the scrap heap are being overhauled, dismasted and equipped with heavy-oil engines, thus insuring another long lease on life for economical operation. The illustrations depict a vessel at the Morse Dry Docks, Brooklyn, N. Y.

LARGE AUSTRALIAN MOTOR SCHOONERS

There are under construction in Australia, at the shipyard of Kildman & Mayoh, two wooden motor-auxiliary five-masted schooners, of the following dimensions:

Deadweight capacity	2,600 tons
Length	250 ft.
Breadth	45 ft.
Depth	24 ft. 5 in.
Loaded draught	19 ft. 10 in.
Power	480 shaft h.p.
Estimated speed	7 knots

The machinery of each ship consists of two Bolinder surface-ignition oil engines of 240 b.b.p. apiece. In our opinion the power is too low for vessels of this sze and that not more than 6 knots (loaded) will result. Also the engines are likely to be used most of the time, unless there is a fair wind. At least 650 shaft h.p. or 800 shaft h.p., in preference, should be installed. If the latter, about 7½ knots could be averaged when loaded, and without sails during calms and against adverse winds; this with a total consumption of not more than 20 barrels per 24-hour day, while the machinery would occupy but little more space. The contract price of these vessels was £26 ($125.53) per deadweight ton.

WHITE-DIESEL OIL ENGINES

We have received an interesting catalogue of the various types of Diesel marine oil-engines from J. Samuel White & Co., East Cowes, England. We note that this firm highly regard the two-cycle system, which they believe possesses many advantages over the four-cycle type, and claim that the power developed in the former is 75 per cent. to 90 per cent. greater for the same number of cylinders, bore and stroke, and revolutions, while the weight is about 65 per cent. of that of the four-cycle engine. The turning movement is more uniform and regular, this being the case when a four-cylinder two-cycle engine is compared with a six-cylinder four cycle.

MARINE DIESEL ENGINE DEVELOPMENT ON THE PACIFIC COAST

The Erection of New Works for the American Engine Company

To record the history of the Atlas Diesel engine and prior to that the story of 5,280 Imperial gas engines as built in San Diego, Cal., would be to present some very interesting data on what has been done when the makers endeavored to instil reliability and endurance into every engine turned out since before 1890.

Mr. A. Warenskjold, designer of the Atlas Diesel engine and president of the recently incorporated American Engine Corporation of Oakland, Cal., recently was in the East with the purpose in view of tentatively selecting equipment for the establishing of a first-class plant to build marine Diesel engines.

For the time being all endeavors will be concentrated on one size of engine, which will be a four-cycle, six-cylinder crosshead 1,000 i.h.p. unit. Nothing definite has been done as yet beyond the securing of seven acres of ground with rail and water facilities; nor will any plant construction be started until the labor unrest and the material markets quiet down, so that rational plans may be made and carried out.

Orders on hand now, for the present Atlas Diesel are sufficient to keep that shop running for a year and a half. Among the successful installations of the Atlas Imperial Engine Co. are those in the Puget Sound ferry-boat "Vashon Island," and in the three twin sets in auxiliary schooners built by Wm. Lyall Shipbuilding Co. of Vancouver. These vessels are named the "Cap Nord," "Cap Vert" and "Cap" Horn."

The organization of The American Diesel Engine Co. is capitalized for $1,000,000 and consists of the following prominent men in business circles on the Pacific Coast:

President—A. Warenskjold, president of the Atlas Imperial Engine Co.

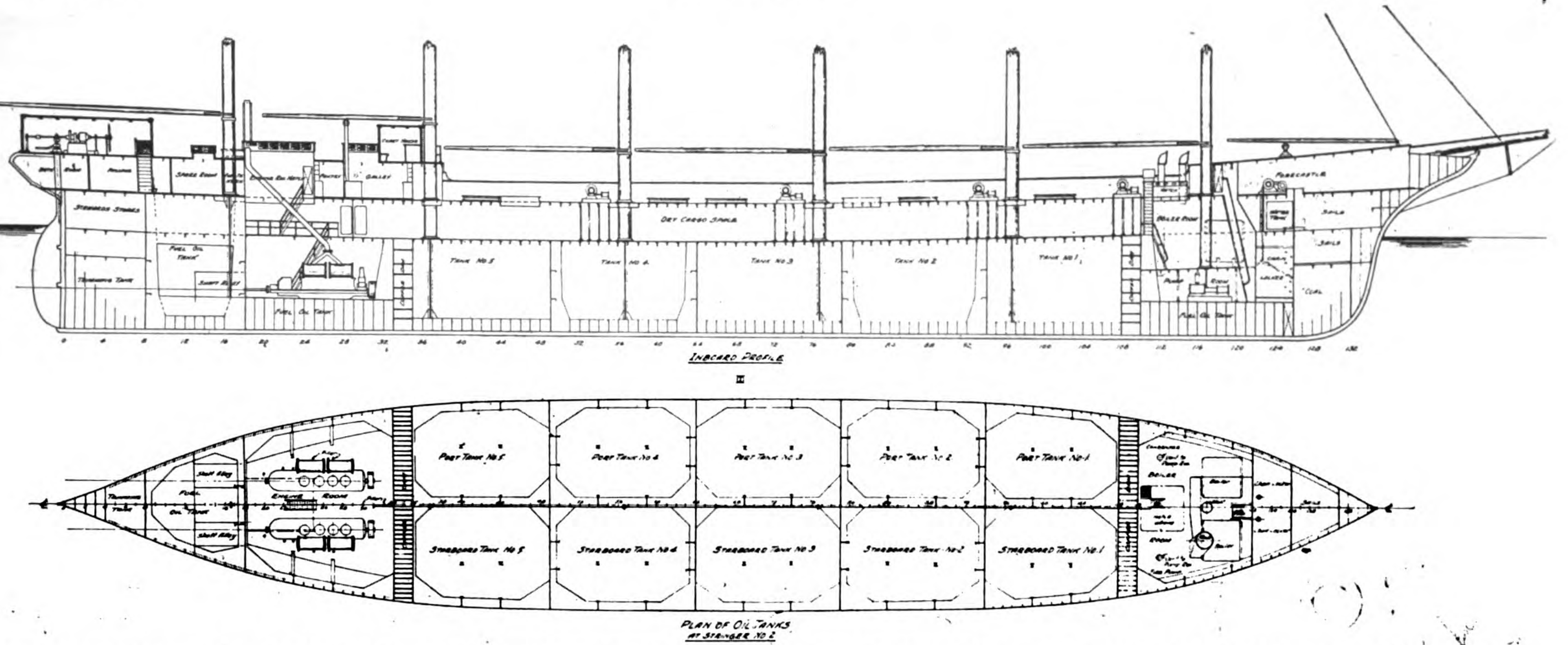
Vice-President—James Tyson, president of the Charles Nelson Co.

Secretary—Phil Bannan, of the Pacific Gear and Tool Works.

Treasurer—J. R. Millar, vice-president and general manager of the California Cotton Mills.

Attorney—Jessie Robinson, of Oakland, Cal.

We wish the company the best of luck with their new venture and trust that labor troubles will be conspicuous by their absence.



General arrangement of tank ship "Katherine," formerly a four-masted iron sailing-ship converted to a six-masted bald-headed motor-schooner equipped with twin 320 B.H.P. Bolinder heavy-oil engines. She is described on page 31

Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial Endorsement of opinions expressed.—EDITOR.)

WHY SOME AUXILIARY VESSELS ARE UNSUCCESSFUL

To the Editor of "Motorship."

Sir:

It may be interesting for you and your readers to know a little about navigating under-powered motorships at sea, and the way that some of them are handled by the captains. You will also see that the engines and engineers are not always at fault when many of these motorships are not the success they promised to be.

For instance, the motorship "————," built at Portland, Ore., has twin 120 h. p. Skandia engines, one 10 h.p. Fairbanks-Morse auxiliary motor and a Delco lighting set installed in her. We started for Buenos Aires, from Portland, Ore., carrying 700,000 board feet of lumber with a deck load 13 or 14 feet high. We arrived at Balboa 63 days later. In Balboa we had a new gasoline tank put in for the torches, of a size sufficient to properly heat up the bulbs, flywheel covers made for the main engines, *ventilators* put down in the *engine-room* (previously they only went down to the top of the fuel tanks), and a new bilge line put in on the starboard side. All these things should have been done in Portland, but the captain refused.

In Colon I ordered two new clutch expanders, the old ones were worn down so that they would hardly grip the clutch. That shows the engines were not big enough for the ship and were overloaded. If we had a little sea, and the ship not making any headway, I could stay down below, and every time the propellers settled into a wave, see a stream of sparks fly from the clutch. Nevertheless, the captain would keep her almost straight up against the wind and sea as though she was a full powered steamer. In the Caribbean Sea we tried to buck against wind and current for 33 days. For 14 days I dare say we hardly made one mile ahead. But we burned lots of oil, and with a steady overload on the engines, two crank-pin bearings burned out. We fixed these at sea and kept on trying and trying to reach Trinidad. No headway could be made against the wind and current, so the captain turned her about and went before the wind for Kingston, Jamaica. Of course, there the captain said that the motors were no good, but nothing was said about his navigation. (If it hadn't been for the two mates we might have been there still.)

We had the motors going for 14 days and 10 hours without a stop, and when they were stopped it was for about two or three hours changing hot-bulbs and cleaning and testing the nozzles. We could not get any oil in Kingston, so instead of going up to Havana, or Key West for some, we left for Buenos Aires with only 15 days' supply of oil for *one motor*.

The trip lasted 108 days, and it sure was a starvation trip. We ran out of provisions, so that we had to make for land, and put in at Pernambuco, Brazil, the 15th or 16th of July. We were paid off and sent home. The captain had to admit that it was good to have motors when we got out in the calms, and they certainly saved our lives. *Without them we never would have made land with that ship.* We arrived at Pernambuco running the engines on gasoline and kerosene.

The Skandia engines are easy to operate and I have nothing against them except that the clutch should have been stronger, but I suppose they would be all right in a smaller boat. The ship ought to have more power, at least 400 to 500 h.p., and then only one engine instead of two. When a good wind blows and heels the boat over one propeller is liable to be out of water too often, also when the motor is not being operated a single-screw will not stop the ship so much.

This motorship is a four-masted, bald-headed schooner. On her trial trip she made 4¾ nautical miles per hour. With a good fair wind she could make about 6 miles with both engines running; but with one engine and sails she generally made three to four miles, *and without either engine she drifted all over the ocean.*

They took off half the deck load in Pernambuco because they could not steer her in any kind of a breeze if the engines weren't running.

If you only consider the ship and the load she had on and the way she was handled, with no fuel for over half the time, the trip might be said to have been a good one. But it was no fault of the engines that the trip was not made any faster.

Yours very truly,

T. ARCHER PEDERSON,
Motor Engineer.

215 Maple Ave., Berkeley, Norfolk, Va.

CHINESE CONCRETE MOTORSHIP

To the Editor of Motorship:

Sir:

I am installing two 500 b.h.p. Diesel engines in a concrete ship being built here by Brossard et Mopin Cie, who also are building several wooden vessels at Tientsien. The dimensions are as follows:

Length Overall	85 metres.
Breadth	11.50"
Draught	5.50"
Deadweight	2,300 French tons.
Speed	10 knots

The ship will carry general cargo as well as sixteen first-class passengers and twelve second-class. All the machinery has been purchased in the States. The main Diesel engines are twin 500 b.h.p. McIntosh & Seymour, and two 25 h.p. Fairbanks-Morse engines for electric light and auxiliary for main engine. Ship's pump and Diesel machinery are all steam driven from a 125 h.p. boiler. The entire ship is of concrete, even the fuel tanks. Also day tanks in engine-room. The trials should be run early in November, and if any information re the trials would interest you, I will give you some more data on her performance, as I expect to be on the ship for a month or so after she is in commission.

Yours very truly,

F. H. HANSEN.

R. R. No. 2, Box 114, Petaluma, Cal.

[We will be very glad to receive further details and photographs. Reference already has been made to this concrete vessel in our columns. —Editor.]

OIL COMPANIES AND MOTORSHIPS

To the Editor of "Motorship."

Sir:

The writer has noted with extreme regret that steam engines and boilers have been installed in the motor vessel "Glenpool," the ex-German motorship "Hagen." It is inconceivable that such a short-sighted policy should be followed by as efficient an organization as the owners of this vessel. I suspect someone is not quite on to his job. The authority responsible for this change is making a grave mistake. Are there not some good, reliable, economical Diesel engines built today that could be installed in this vessel instead of steam? While it is true that the "Glenpool's" engines have given a great deal of trouble and have cost a lot in upkeep, she was a pioneer ship. That does not mean that later and more successful Diesel engines should not be installed.

It is to be hoped that the motorship will be given better support than it has heretofore by the large fuel oil companies. Their indorsement by large and long established steamship lines should be proof that proper installations may be made.

Yours very truly,

GEORGE NICHOLSON.

107 Union St., Jersey City, N. J.

GERMAN SUBMARINE FLEET

During the war 765 submarines were built by Germany. Prior to the war Germany had only completed 45 submarines.

FISHING SCHOONER TO HAVE OIL ENGINE

In a fishing schooner building for Messrs. W. & T. Hollett, of Burin, Nfld., by Shelburne Shipbuilders, Ltd., of Shelburne, a pair of crude oil engines are fitted driving twin-screws. The vessel is classed for 12 years with the BureauVeritas.

ANOTHER HANNEVIG MOTOR AUXILIARY

A wooden auxiliary motorship, 238 feet long, 40 feet beam and 20 feet draught is under construction at the yard of the Slidell Drv Dock and Shipbuilding Co., Slidell, La. She will be one of the highest powered motor auxiliaries in the world being fitted with two 500 h.p. Diesels.

"Motorship" Illustrated Patent Record*

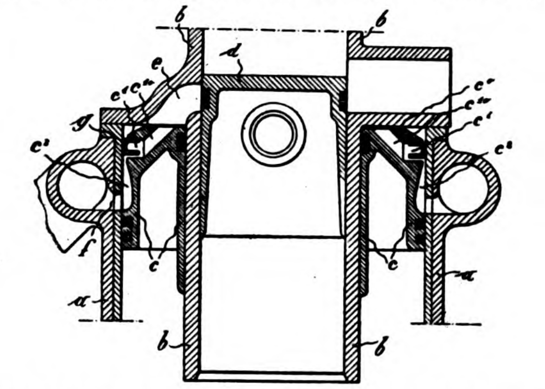
Selected Abstracts of Recent Published Patents of Internal Combustion Engines

Copies of original specifications may be obtained for ten cents each, by addressing the "Commissioner of Patents, Washington, D. C."

***Compiled and described by H. Schreck, Consulting Diesel Engineer**

1,305,567. June 3, 1919. Piston. P. A. Ritter, of Kiel, Germany, Assignor to Fried. Krupp Germaniawerft, of Kiel-Gaarden, Germany.

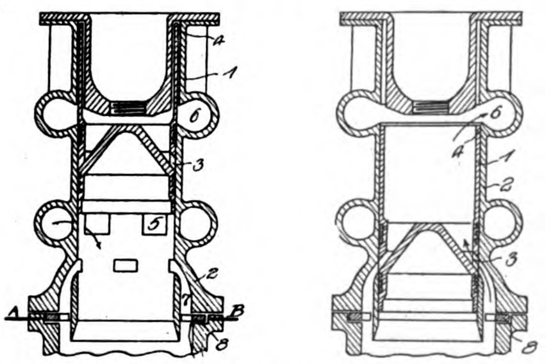
This invention refers to an expansible piston for double-acting engines. The piston has two separated cylindrical portions between which there is inserted a U-shaped elastic diaphragm H. This design provides hollow cone-shaped supporting members D and D¹ which carry the piston heads and which in that way transmit the working pressure on the two sides of the piston directly to the piston rod. This arrangement allows of a very thin wall for the cylindrical part of the piston, and provides for a quick transmission of the heat to the cooling water. The cylindrical portions are radially unrestrained by the piston rod,



and since said walls are made comparatively thin a radial and axial expension of said portions is possible and is made independent of each other by the inserted expansion ring.

1,306,661. June 10, 1919. Valveless two-cycle Engine. G. Doine-Dehan, of Cointe, Belgium.

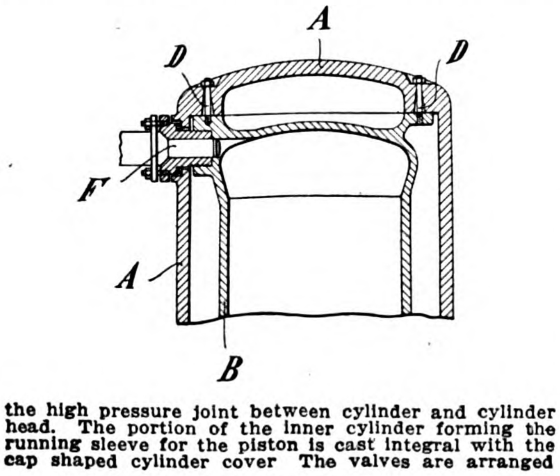
This invention refers to two-cycle engines with an enclosed crank case. The working piston when rising creates beneath it a partial vacuum until the ports 5 are uncovered by the lower edge of the piston. The fresh gas conducted through a circular pipe is drawn into the body of the pump and the crank case. Upon the down stroke of the piston the gas or air thus introduced into the pump and confined therein when the ports 5 are closed is slightly compressed until the moment when passages 3 register with the passages 7.



The burned gases from the preceding explosion after expansion are exhausted through the circular passage 6 and are completely expelled by the scavenging effect of the fresh gas. It will be noticed that this scavenging takes place without any appreciable mixing of the new and burnt gas owing to the arrangement of the ports. This may be considered quite a distinct advantage over the customary port scavenging in this type of engine. See also the September, 1919, Patent Record of "Motorship" for additional two-cycle scavenging schemes.

1,305,494. June 3, 1919. Engine Cylinder. C. Regenbogen and P. A. Ritter, of Kiel, Germany.

This invention refers to a novel design of a Diesel engine cylinder, the object of which is to eliminate

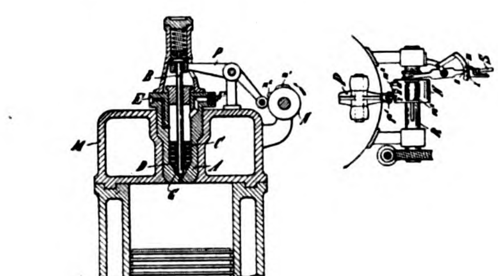


the high pressure joint between cylinder and cylinder head. The portion of the inner cylinder forming the running sleeve for the piston is cast integral with the cap shaped cylinder cover The valves are arranged sidewise and are made watertight to the cooling water by means of stuffing boxes. The arrangement as a whole is devised so as to permit axial and radial expansion of the cylinder and to permit displacement between said cap and the outer jacket.

1,310,565. July 22, 1919. Fuel-injecting Device. C. Grunwald, of Bredeney, Germany.

This invention relates to an improvement of the gear of injection valves using slowly igniting fuel such as tar oil.

In engines running on such oils, the ignition very often fails to occur when running with a light load. The reason for this is that with a light load only a small quantity is injected, consequently the fuel at each



opening of the needle is completely cleared away from the atomizer, so that when the fuel valve is next opened, very cold compressed air is first blown into the cylinder, which prevents the subsequent ignition of the fuel. It has, on the other hand, been found that the ignition occurs with certainty, when provision is made for even a very small quantity of fuel to be present in the space directly above the needle seat of the fuel valve when the latter is opened.

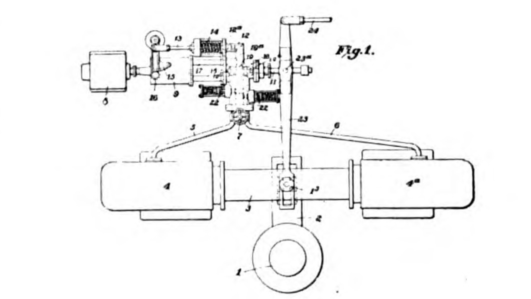
In order to attain this the inventor brings the circular space located above the needle seat momentarily in connection with the inside of the working cylinder before the regular injection of the fuel. For this purpose a very small cam n2 is arranged in front of the fuel cam n1. This auxiliary cam causes a momentary opening and closing of the fuel needle and a consequent advancement of fuel supplied by the pump will take place in the atomizer. At the second opening of the needle fuel is injected before the air, so that a more certain ignition is assured.

As the danger of the ceasing of the ignition only exists when the engine runs under a light load this control of the valve needle may be arranged, as shown in Fig. 2 with different cams. Cam m1 is a wide cam. It controls the fuel injection and is good for all loads. Cam m2 in postion III is for very light load or without any load, position II is for about half load, and position I is for full load, in which position the primary cam is not needed at all.

1,309,076. July 8, 1919. Ship's Steering Gear. C. E. Paine, of Bath, Me.

Electro-hydraulic steering engines are in great favor on motor ships, and, therefore, a recent patent referring to this type of gear is published in these columns. The object claimed for this particular apparatus is that a system is provided by which the proper movements may be imparted to the rudder without the use of a reversible pump for securing the proper flow of pressure fluid to operate the steering ram in either directions.

Referring to the illustration this apparatus works as follows: The numeral 1 designates the rudder post, carrying the tiller arm 2 which extends into a slot in member 3 which connects the two working pistons arranged in opposed cylinders 4 and 4a. The pistons are operated by a fluid forced through pipe 5 or 6, respectively, depending on which way the rudder is

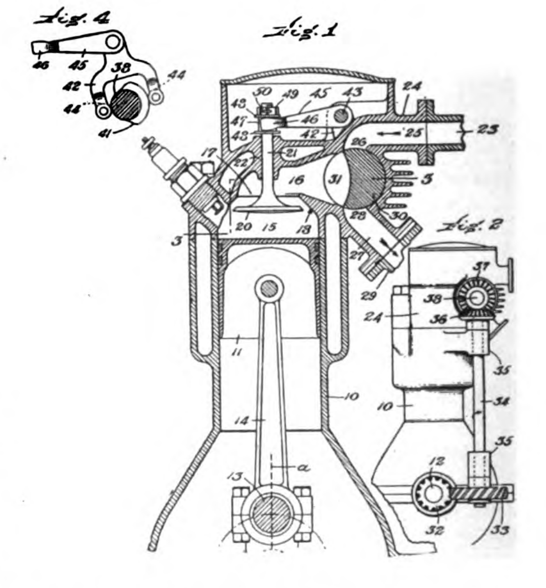


intended to be turned. The numeral 8 designates an electric motor which is coupled to a non-reversible, but variable stroke, pump. The fluid is forced through pipe 17 into chamber 19 and from there is distributed by means of piston valve 10 to one or the other of the working cylinders. The fluid from the other cylinder being led back to the pump through chamber 20 or 20a, respectively, and pipe 18. As soon as the ram 3 has then been moved, the follow-up lever 23 will bring valve 10 back into its neutral position. Then, the pump which is running continuously, will build up a pressure in chamber 19, which in turn when reaching a certain maximum pressure, will act on piston 12a, which actuates the rod 13, and by transmission of the gear 15 and 16 cut down the supply of the pump or even reduce the supply temporarily to zero until the next handling of the rudder takes place.

1,311,200. July 29, 1919. Internal Combustion Engine. R. Abell, of Milton, Mass.

This patent refers to an improvement of the valve gear of internal combustion engines of the four-cycle type.

Instead of using one valve for exhaust and another valve for inlet, this engine has one valve for these two purposes and an additional revolving valve 31, which connects the exhaust gases and the incoming air with their respective connections. The advantage in this one-valve arrangement is the cooling action of the fresh air charge passing this valve immediately after the combustion and exhaust stroke. The valve does not become heated to the temperature which often causes an ordinary exhaust valve to pit or to warp.



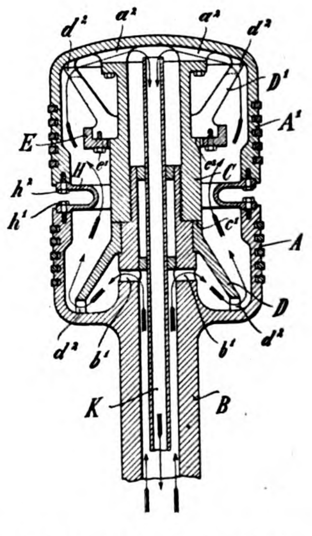
In order to improve the operation of the valves, the inventor employs a positive opening and closing of the valve by two co-operative cam-engaging shoes, which are illustrated in Fig. 4. But this feature is only suggested for high-speed engines on which the relatively slow action of a spring is not quick enough to overcome the inertia of the valve when operated at high speeds, as in modern auto and aero engines.

A previous invention of a similar nature is that numbered 1,304,735, reported in the October issue. This former scheme had two ordinary valves for the inlet and exhaust, in addition to the third valve, which opened into the combustion chamber, instead of the rotary valve illustrated herewith.

1,307,895. June 24, 1919. Piston. G. E. Chédru, of Paris, France.

This invention refers to the construction of the scavenging pump piston of a two-cycle engine in which the scavenging piston consists of an annular body surrounding the main working cylinder. The object of this invention is to provide a valveless scavenging pump to correct the fault which is inherent in stepped piston design, which is, that during the downward or suction stroke combustion gases may blow down into the scavenging cylinder past the working piston due to the vacuum in the scavenging cylinder during the suction stroke.

For this purpose there is a ring g provided which really replaces the suction as well as discharge valves. This ring owing to its momentum as well as to its friction on the cylinder wall rests during the upward stroke of the piston against the lower face of the



annular groove c¹ thus closing the air conduits c³, and on the downward stroke against the upper face of the groove thus allowing fresh air to enter through the conduits c³ and c¹⁰ into the scavenging cylinder.